

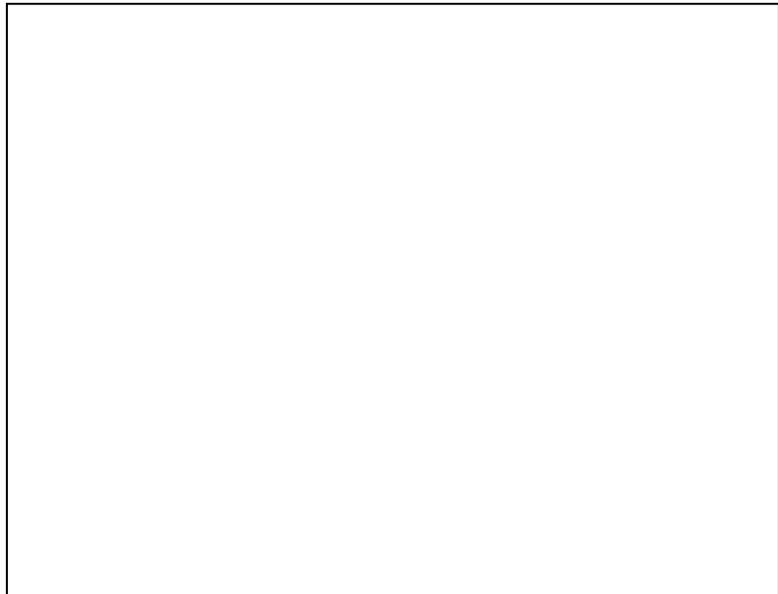
**Georgi Stankov**

**The Universal Law**

\*

**The General Theory of  
Physics and Cosmology**

Volume II





Georgi Stankov

The Universal Law

\*

The General Theory of  
Physics and Cosmology

Volume II

- Full Version -

**STANKOV'S UNIVERSAL LAW PRESS**

Stankov, Georgi  
**The Universal Law**  
**The General Theory of Physics and Cosmology**

Copyright © by Georgi Stankov, 1998

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior permission of the author.

This book is sold subject to the conditions that it shall not, by way of trade or otherwise, be lent, re-sold, hired out, or otherwise circulated without the author's prior consent in any form of binding or cover other than that in which it is published and without a similar condition including this condition being imposed on the subsequent purchaser.

ISBN 3-00-000142-5

Stankov's Universal Law Press  
München, Sofia

*For Annette*



## CONTENT

PREFACE.....	11
1. INTRODUCTION.....	19
1.1 A critical analysis of modern physics.....	19
2. THE FOUNDATIONS OF THE NEW PHYSICAL AXIOMATICS..	23
2.1 Philosophical propaedeutics.....	23
2.2 Intuitive formalistic statements.....	25
2.3 Empirically verifiable statements and mathematical derivations.....	26
Essays under the following points:	
Point 24: Systems of measurement and units in physics.....	43
Point 37: Probability set and continuum are mathematical concepts of space-time.....	59
3. CLASSICAL MECHANICS.....	99
3.1 Formalistic methods of presentation.....	99
3.2 Newton's laws.....	105
- Hooke's law.....	109
- The General Continuum Law is the differential form of the Universal Law.....	112
3.3 Work and energy in mechanics.....	116
3.4 Space-time of rotation.....	121
3.5 Kepler's laws.....	126
3.6 Newton's law of gravity is a derivation of the universal equation (ND).....	128
3.7 The ontology of Newton's law from consciousness - A paradigm of how physical laws are introduced in physics (ND).....	132
- The radius and the mass of the earth are functions of photon space-time.....	145
3.8 Mass and mind.....	146
3.9 Mass, matter and photons (ND).....	151
3.10 Mechanics of solids and fluids.....	157
4. WAVE THEORY.....	159
4.1 Oscillations.....	159
4.2 Chaos theory.....	164
4.3 Mechanical waves.....	165
4.4 Standing waves and quantum mechanics.....	169
4.5 Wave equation.....	172
4.6 The action potential as a wave.....	173
4.7 The Doppler effect.....	176

4.8	The mechanism of gravitation (ND).....	178
5.	THERMODYNAMICS.....	188
5.1	What is temperature? .....	188
5.2	The ideal-gas laws.....	191
5.3	Boltzmann's law and the kinetic theory of gases.....	194
5.4	Heat and the first law of thermodynamics (ND).....	199
5.5	Laws of radiation (ND).....	205
5.6	Entropy and the second law of thermodynamics (ND).....	208
5.7	Stankov's law of photon thermodynamics (ND).....	217
6.	ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM.....	223
6.1	Etymology of concepts.....	223
6.2	Basic quantities and units of electricity (ND).....	226
	- The charge of the basic photon $q_p$ is the elementary area ( $K_e$ ) of space-time.....	231
	- The fundamental unit of charge $e$ is geometric area of the electron.....	233
6.3	What are permittivity and permeability of free space (ND)? .....	236
6.4	Coulomb's law and the electric field.....	241
6.5	Gauß's law and its applications.....	246
6.6	Nabla- and Laplace-operators.....	248
6.7	Electric potential.....	252
6.8	Capacitance, dielectrics and electrostatic energy.....	254
6.9	Electric current and superconductivity.....	257
	- Essay: The theory of superconductivity in the light of the Universal Law.....	261
6.10	The magnetic field.....	267
6.11	The quantum Hall effect (ND).....	274
6.12	Precursors of Maxwell's equations - electromagnetism of matter.....	277
6.13	Maxwell's equations are derivations of the Universal Law.....	283
6.14	The wave function is the differential form of the universal equation.....	290
7.	QUANTUM MECHANICS.....	293
7.1	Bohr model of energy quantization anticipates the inhomogeneity of space-time (ND).....	293
7.2	Schrödinger's wave equation of quantum mechanics is an application of the universal equation.....	307
7.3	Heisenberg uncertainty principle is an intuitive notion of the Universal Law.....	315
7.4	Selected solutions of quantum mechanics in the light of the Universal Law.....	319
	1. Example: What is electronvolt? .....	319

2. Example: Rest mass and binding energy of hadrons.....	320
3. Example: The mass of the $\pi$ -mesons (pions) is a function of the mass of the basic photon.....	323
4. Example: Annihilation of particles and antiparticles.....	324
5. Example: Experimental research in physics is a tautology of the Universal Law.....	325
6. Example: How to calculate the mass of neutrinos? .....	327
8. SPACE-TIME CONCEPT OF PHYSICS.....	333
8.1 Classical mechanics.....	333
8.2 The concept of relativity in electromagnetism.....	336
8.3 The space-time concept of the special and general theory of relativity.....	341
8.4 Rest mass is a synonym for the certain event. Relativistic mass is a synonym for Kolmogoroff's probability set.....	345
9. COSMOLOGY.....	347
9.1 Introduction.....	347
9.2 Hubble's Law is an application of the Universal law for the visible universe.....	351
9.3 From Newton's law to the visible universe (ND).....	353
9.4 The cosmological outlook of traditional physics in the light of the Universal Law.....	357
9.5 The role of the CBR-constant in cosmology.....	360
9.6 Pitfalls in the conventional interpretation of redshifts.....	363
9.7 What do „Planck's parameters of the big bang“ really mean (ND)?.....	368
9.8 Adiabatic expansion of the universe.....	374
9.9 Derivation rule of absolute constants (ND).....	377
- Galilei's famous experiment of gravitation assesses the Universal Law with the Pythagorean theorem.....	381
- The numerical input-output model of space-time.....	387
10. CONCLUSION.....	397
REFERENCES.....	403
INDEX.....	409



## PREFACE

Any genuine discovery has a specific, individual history that goes beyond the impartial scientific presentation which it acquires after accomplishment. To comprehend a scientific breakthrough as a personal, human endeavour, one has to know how the ideas have evolved in time before they have been moulded into a written form. To highlight this aspect, I will say a few words on the chronological discovery of the Universal Law in science. I deliberately say “in science“ and not “in nature“ because the Law is an integral part of consciousness and all scientific disciplines which it integrates are *a priori* categorical systems of the human mind; these are applied in a secondary manner to the external world. The epistemological arrow of knowledge points from the mind towards nature and not vice versa - scientific discoveries occur initially in the mind and are only then confirmed in nature. Contrary to the general belief, fundamental scientific discoveries are never a product of empiric research - the latter is rather a consequence of the scientific ideas of human consciousness. The present volume will prove this basic aspect of human cognition in a profound way.

In 1993, in the course of my clinical research activities which I was carrying out with a growing discontent from a scientific point of view - I realized that any clinical research operated in a state of a profound agnosticism with respect to the regulation of human cells and the organism so that the results which we obtained were more than doubtful -, I discovered through pure introspection a novel principle of biological regulation that had not been previously described. This principle assessed the energy transformation in the cell. Based on this principle, I could explain for the first time the dynamic regulation of the cell and the organism, while incorporating the abundance of scientific facts in the bio-sciences that previously could not be fitted into a coherent theory. This initial discovery was a tremendous revelation that swept away my grudging discontent with present-day science as a source of cognition, which had been tormenting my mind since my early youth. In a frenetic effort, I developed within a short period of time this principle into a **general theory of biological regulation**. It includes all bio-sciences, such as biology, biochemistry, physiology, genetics, medicine and pharmacology. Its chief achievements are: 1) a new unified theory of the pathology of diseases, such as cancer and AIDS; 2) a new axiomatic science of the pharmacological effects of drugs and related agents based on just a few postulates that allow one to predict the therapeutic and adverse effects of any drug or chemical entity from its chemical structure; 3) a new approach to the dynamic regulation of the genetic code that allows for the first time the explanation of gene sequences and mutations in terms of protein structure and function in the cell; 4) a new theory of the treatment of chronic diseases, most of which are incu-

rable with conventional methods of therapy. The latter was confirmed by clinical results.

As the reader may perceive, the first phase of my discovery was closely linked with my professional interests and activities as a physician. I began with the writing of the general theory of biological regulation in 1994 and had to modify it many times before it acquired its final version in the spring of 1999. This theory is given in volume III of the present tetralogy.

In 1994, while I was still elaborating the general theory of biological regulation and testing its validity on the basis of numerous publications, I came to the conclusion that this energetic principle was a manifestation of a **Universal Law of Nature**. I knew from my previous physical studies that conventional physics rejected the existence of a single law of nature and that its theory was based on the description of numerous laws, such as: Newton's three laws of classical mechanics, Newton's famous law of gravitation, Kepler's laws on the rotation of planets, a number of laws on the behaviour of gases, fluids and levers, the first law of thermodynamics on the conservation of energy, the second law of thermodynamics on the growing entropy, diverse laws of radiation, numerous laws of electrostatics, electrodynamics, electricity, and magnetism which are summarized in Maxwell's four equations of electromagnetism, laws of wave theory, Einstein's famous law on the equivalence of mass and energy, Schrödinger wave equation of quantum mechanics and so on. The very listing of these numerous laws, according to which physical nature was believed to operate as an ordered whole, had an exasperating impact on my intellectual efforts. On the other hand, I recalled that Einstein himself must have believed in the existence of "a universal field equation" with which all physical laws could be integrated. His belief had been shared by many famous physicists between the two World Wars. Although none of them had succeeded in finding this universal field equation, the hope had not been wholly abandoned, notwithstanding the fact that modern physics had, in the meantime, drifted away from its past striving for unification.

The task was challenging, but not impossible. The novel principle of biological regulation discovered by myself allowed the exact calculation of the energy exchange in the cell and the human organism. If this principle was valid for such a complicated energetic system as the biological organism, it should also hold in inorganic matter. This conviction gave me the strength to apply it to the physical world. The mathematical expression of this principle was identical to that of Planck's equation for the energy of photons:  $E=hf$ . In fact, it was a simple function  $y=ax$  which can also be presented as a rule of three:  $a=b/c$ . My intuition was telling me that, before I should implement this principle for the unification of all known physical laws, I ought to establish the epistemological basis of this equation. For this reason I resorted to the principles of mathematical formalism and solved the problem within the theory of mathematics. I came to the conclusion that there is a **primary term** of our consciousness, from which all other mathematical terms can be derived in an **axiomatic**

manner. As all physical laws are mathematical equations, this should also hold for these formulae. I analysed the numerous laws from an epistemological point of view and came to the conclusion that they all assess various energetic interactions. I concluded that “**energy**“ should be the primary term of physics. As this discipline had also introduced the term “**space-time**“ in the theory of relativity, I had to show in a second step that energy and space-time were equivalent terms. In this process, I defined the properties of the primary term “energy = space-time“ in an irrevocable manner and showed that both mathematics and physics could be axiomatically derived from this term. It is important to observe that until then physics did not know what energy really was. In this way I developed the outlines of a **new physical and mathematical axiomatics** based on a few symbols (**space-time symbolism**). Equipped with this powerful tool, I immersed into the cognitive abysses of conventional physical theory. By the end of 1995, I was able to show that all known physical laws and their applications can be derived from this one law by means of mathematics. I called it the “**Universal Law**“.

In this process, I discovered many new physical constants and derivations which have hitherto evaded the attention of physicists. These natural constants can be verified in experiments. The new axiomatic approach made it possible for me to develop within a short period of time a **unified theory of physics**. This theory also explained gravitation and integrated it with the other physical forces. At the end of 1995 and the beginning of 1996, I made a major breakthrough in cosmology. This ultimately led to the refutation of the standard model (the “big bang“ hypothesis) as the core of present-day cosmology. Subsequently, I developed a new comprehensive theory of cosmology based on the Universal Law.

The present volume II contains the basic achievements of the new unified theory of physics and cosmology. It covers the physical theory as presented in standard textbooks on physics and cosmology for students worldwide. I have deliberately adopted their common didactic pattern to facilitate the reader’s comprehension of the new theory. After a thorough introduction into the basic statements of the new physical and mathematical axiomatics, the book proceeds with the applications of the Universal Law in classical mechanics, wave theory, thermodynamics, electromagnetism and quantum mechanics, and ends up with the theory of relativity and cosmology. Each section contains numerous exercises concerning practical applications of the Universal Law. This volume can be used as a complete textbook on the new theory of physics and cosmology by physicists, students of physics and other scientists with a good knowledge of physics and mathematics.

The new theory of the Universal Law is based on the principles of **mathematical formalism** as first outlined by Hilbert in 1900 and since developed by many prominent mathematicians in this century. With this integrated axiomatisation of physical and mathematical theory, I solved the continuum hypothesis as embodied in Russell’s antinomy by providing the missing exis-

tence proof (“Existenzbeweis“) and thereby proving the consistency of mathematics that had remained challenged since Gödel’s first theorem of 1931. In this way I eliminated the “foundation crisis“ in mathematics that had existed since the publication of this theorem. In addition, I was able to develop the theory of mathematics further by proving that the transcendental numbers are the only correct symbols and solutions of mathematics as applied to the physical world. The outlines of this new integrated theory of physics and mathematics are presented in volume I (679 pages) of the present tetralogy which appeared in Munich in 1997 under the title “Das Universalgesetz. Vom Universalgesetz zur Allgemeinen Theorie der Physik und Wissenschaft“.

Volume II is a further elaboration of the integrated physical and mathematical axiomatics to a unified theory of physics and cosmology which can be read independently of volume I. However, I recommend the reader to begin with volume I and only then proceed with volume II. In the first two volumes, I prove in detail that physics is **mathematics applied to the physical world**, so that this natural science has no right of existence as a separate empiric discipline. This is a severe blow to the physical community at a time when the importance of physics for the economy and everyday life is dramatically diminishing and may explain the initial resentment, with which the new theory of the Universal Law was met by the protagonists of this science.

As the reader may convince himself, the new theory incorporates the whole edifice of physical disciplines. However, it disproves a number of wrong concepts, among them, the conclusions of the second law of thermodynamics (the law of entropy), while showing that the mathematical derivations of this law intuitively reflect the Universal Law. Since the law of entropy is in apparent contradiction to biological evolution, which nobody can now reject, overturning the notion that entropy always increases has eliminated the fundamental antithesis of modern science - the existence of highly organized organic matter versus dissipating inorganic matter (Darwin versus Boltzmann).

The new theory leads ultimately to the development of an integrated **input-output model of the universe** that consists of natural, dimensionless constants. This numerical input-output model is equivalent to the continuum of set theory as established by Cantor. It is the ultimate scientific system which incorporates all known categorical systems of natural sciences, philosophy and religion.

At the beginning of 1998, after I had finished with volume II<sup>1</sup>, I could show that this model was also applicable to the major economic theories of

---

<sup>1</sup> Volume II was written in English. When I finished it, I immediately dedicated myself to its translation in Bulgarian language. My ambition was to publish this volume first in my native language in my native country. The book appeared in May 1999 and was broadly discussed by the scientific community in my country. However, very few Bulgarian scientists really comprehended the new theory. Parallel to the Bulgarian translation, I prepared a concise version of volume II and published it in World Wide Web.

keynesianism and monetarism, which I had already derived from the theory of the Universal Law in 1995. I proved that Leontieff input-output models of macroeconomics, with which GNP is calculated, are applications of the input-output model of the universe. In a subsequent survey of the various theories on economic behaviour from antiquity to modern times, I provided ample evidence that all human activities abide by the Universal Law - from double-entry to stock markets. I could show that all fundamental ideas in economics were intuitive perceptions of the Universal Law. In 1999, I elaborated the basic macro- and microeconomic ideas in the light of the Universal Law in a collection of lectures on modern theory of economics and published it in internet. Simultaneously, I applied the new economic theory of the Universal Law to the world economy and predicted its irreversible collapse within the next ten years beginning with a continuous and prolonged baisse of all stock markets worldwide in 2000.

Parallel to these economic studies, I was preoccupied with the role of the Universal Law in philosophy, theosophy and human gnosis. I came to the conclusion that the mainstream of European gnostic thinking and the great religions of mankind, such as Thracian pantheism, Greek mythology, Christianity, Islam and Asian religions, are intuitive perceptions of the Universal Law on the spiritual level. This insight allowed the integration of all social sciences and arts as particular and partial perceptions of the Universal Law. The philosophical and ethical aspects of this integrated *weltanschauung* are summarized in volume IV, which I prepared simultaneously to this volume. Further areas of human gnosis will be covered in separate books that complement the present tetralogy. These scientific works are the first step towards “one world“: “one science“. It goes without saying that this task is beyond the physical capacity of a single scientist - it could be only solved through the aggregated efforts of the international scientific community.

The present volume includes the basic applications of the Universal Law in physics and cosmology. It is organized as an **empiric axiomatics**<sup>2</sup>, which is derived from a single concept - **energy (space-time)**. The primary term is explained epistemologically and confirmed by the vast experimental evidence collected in physics over the last four centuries. The major statements and achievements of the new physical theory presented in this volume can be summarized as follows:

**1)** The basic terms **energy** and **space-time** are **one and the same entity** (equivalent semantic terms). Energy (space-time) is equivalent to the continuum (the set of all numbers) in mathematics. Energy, space-time, continuum is the primary term from which all scientific terms and categorical systems can be axiomatically derived. Energy (space-time) has only **two** dimensions, **space** and

---

<sup>2</sup> While the term “axiomatics“ is a basic scientific concept in most European languages, this word does not exist in English. This fact brings into a focus the cognitive misery of modern Anglo-Saxon empiricism in science and philosophy.

(absolute) **time**. Both are numbers (relations). All known physical dimensions of the SI system can be derived from these two dimensions. This allows the elimination of the SI system in the presentation of physical quantities. Empirical sciences always assess the Universal Law in their particular object of investigation.

2) All known physical laws and their applications can be derived mathematically from the **Universal Law (universal equation)** and explained epistemologically by it. The Universal Law is a **law of energy**.

3) There is no vacuum. There are only photons (**photon level**) perceived as space (extent). The photon level has the same properties as matter, i.e., it has **mass** and **charge**. I have discovered two new fundamental constants: the **mass**  $m_p = 0,737 \times 10^{-50} \text{ kg}$  and **charge**  $q_p = 1,29669 \times 10^{-39} \text{ m}^2 (= \text{coulomb})$  of the **basic photon** (Planck's constant  $h$ ). With the help of these constants I have integrated all physical constants by applying the universal equation (see Table 1, inside cover page). This is a basic proof that the physical world is a unity.

4) I have derived many new constants that have hitherto evaded the attention of physicists and have shown the principal method for obtaining many more physical constants. These constants can be experimentally verified.

5) *Charge* is a synonym for **area**. The SI unit 1 *coulomb* is equivalent to 1 *square meter* ( $1C = 1m^2$ ).

6) The basic terms, **time**, **temperature** and **relativistic mass**, are physical circumlocutions for the probability set ( $0 \leq P(A) \leq 1$ ) as introduced by Kolmogoroff in his theory of probabilities.

7) The standard model of cosmology (the hot *big bang hypothesis*) must be refuted - the **universe does not expand**. Instead, there is an incessant exchange of energy and mass between the photon level and matter. This exchange, being responsible for *gravitation*, can be confirmed by the discovery of many new cosmological constants. These constants build a numerical **input-output model** of the universe. This model is equivalent to the continuum set.

8) The standard model of physics must be refuted in its reductionist attempt to explain nature on the basis of a few elementary particles. At the same time the new theory confirms the mathematical and physical results obtained in QED (quantum electrodynamics), QCD (quantum chromodynamics) and GUT (grand unified theory)<sup>3</sup>.

---

<sup>3</sup> A detailed discussion of QED and QCD is beyond the scope of this volume. However, departing from the new theory, the results of QED and QCD can be interpreted

9) All physical quantities and related terms are derived from the primary term in the mind and are only then confirmed in the external physical world. Therefore they have no physical existence independently of human consciousness. As they are of mathematical character, **physics is mathematics applied to the physical world** and has no right of existence as a distinct explorative science.

In July 1997, I sent 500 copies of volume I to prominent scientists, physical institutes and scientific journals and wrote in an accompanying letter:

„As you can see, the new theory is based on clear-cut axiomatic statements and proofs that affect the foundations of physics and mathematics. Any physicist, mathematician, or scientist interested in these areas and endowed with good will should easily be able to determine, whether the aforementioned facts in points 1) to 9) are true or not. Since the new integrated theory of physics and mathematics is developed as a **system of axioms**, i.e., it follows the principle of *inner consistency* and *lack of contradiction*, it would be sufficient to refute only one of the nine points, as given above, to reject the existence of the Universal Law. If not, the consequence is a dramatic change in scientific thinking and behaviour. This will profoundly affect research and society.“

Until now nobody has been able to reject the existence of the Universal Law and it is unlikely that this will happen in the foreseeable future. The reason for that is very simple - one does not need any physical or mathematical knowledge to comprehend it: The Law is “being itself“ (“das Sein“), and we are part of being. As long as we are in a position to think, we cannot reject our existence and that of being. Accepting the real world as it is, we develop an intuitive feeling for the Universal Law. Human perceptions and intelligence always assess the Universal Law in the pluripotent variety of physical forms and events because it is already part of the mind. In volume III, I show that the neurobiological transmission of signals in the central nervous system obeys the Universal Law. No science or categorical system could have been developed without an *a priori* knowledge of the Universal Law because our very thinking and intelligence is based on it.

Thus consciousness is liberated from its present oblivion in modern empirical science and becomes central to every scientific endeavour. We realize that scientific thinking and perception of the world, being essentially mathematical, are metaphysical manifestations of the Universal Law and that the human mind and nature are not separate entities, as they are regarded in

---

in terms of the Universal Law, as is shown for the basic physical disciplines, including classical quantum mechanics, in the present volume.

science today, but dialectical aspects of being. In finding this, we rediscover Heraclitus' Logos, also called primordial fire, flux, consciousness, logic, the word, God etc. The Logos was considered for many centuries to be the divine law of nature, to which the self-organisation of society should also be subjected. It was basic to the idea of caesaropapism in Hellenism, in the late Roman and Byzantine Empire, as well as in Russia (Third Rome), and has been promulgated into the religious concept of God in Christianity. The emotional and intellectual perception of Heraclitus' Logos is the spiritual source of European philosophy. Its influence can be traced down to all major schools of thought, departing from the theory of knowledge, such as Cartesianism, Spinoza, Leibniz, Rousseau, Kant, Hegel's dialectics, The Romantic Movement, Darwinism, Spencer's social Darwinism, dialectical materialism, William James' monism and so on, but not to empiricism as developed by Locke, Berkeley and Hume<sup>4</sup>. This is the fallacy of modern empiricism that dominates science at the end of the Second Millennium - it has postponed the (re)discovery of the Universal Law for more than three centuries.

Munich, November 1997

Revised: April 1999

---

<sup>4</sup> "The difference of method, here, may be characterized as follows: In Locke or Hume, a comparatively **modest** conclusion is drawn from a broad survey of many facts, whereas in Leibniz a vast edifice of deduction is pyramided upon a pin-point of **logical** principle...This difference of method survived Kant's attempt to incorporate something of the empirical philosophy; from Descartes to Hegel on the one side, and from Locke to John Stuart Mill on the other it remains unvarying". B. Russell, History of Western Philosophy, G Allen & Unwin, London, 1975, p. 619.

## 1. INTRODUCTION

### 1.1 A CRITICAL ANALYSIS OF MODERN PHYSICS

The new physical theory begins with a methodological analysis<sup>5</sup> of the epistemological foundations of modern physics. It reveals that the basic terms of this science are not resolved. As all physical laws are **laws of energy** (laws of energy interactions), or can be derived from the concept of energy, for instance, Newton's Second Law of force  $F = ma$  can be presented as a law of energy  $E = Fs$ , one would expect that the fundamental term "energy" is well understood. This is, however, not the case. For example, R. Feynman underlines in his "Lectures on Physics", how important it is to realize that modern physics does not know what energy is<sup>6</sup>. Another fundamental concept of physics, **space** or **space-time**, is not clearly defined either. According to Newton, space is *empty* and *absolute* (*Euclidean space*). In Einstein's general theory of relativity the *Minkowski world* that consists of the three-dimensional space of classical mechanics, to which a fourth coordinate of time is added, is also empty; at the same time it is considered to be bent (curved) from a geometric point of view. There is, however, no explanation of how an empty space can be bent.

---

<sup>5</sup> The *methodology of science* is a new discipline which departs from the „Erkenntnistheorie“ (epistemology) of the German philosophical school and the theory of science as established by Kuhn, Popper and other modern theoreticians. I have further developed this theory by using the hermeneutic approach in a consistent way. It begins with an analysis of the structure of a given empirical science, as it has historically evolved to its present state. This presupposes a detailed and universal knowledge of the fundamental scientific "stuff". Beginning with the basic definitions of a scientific discipline, which as a rule allow a mathematical presentation, the aim of this novel approach is to find a general formalistic procedure, which allows the axiomatic derivation of all terms and concepts of a categorical scientific system from a single primary term or concept. This methodological approach is identical to the principle of mathematical formalism as first suggested by Hilbert, which has led to the partial axiomatization of this discipline. The full axiomatization of mathematics is achieved in the new axiomatics. When a scientific discipline, for instance, physics or bioscience, is completely analysed and axiomatized (organized) in the aforementioned manner, its basic terms are compared with those of mathematics. Ultimately, all basic scientific terms are axiomatically derived from the primary term of space-time, so that all current scientific disciplines are integrated into a consistent, axiomatic **General Theory of Science** as presented in this tetralogy.

<sup>6</sup> R. Feynman, *Vorlesungen über Physik*, vol. 1, Munich, 1991, p. 60.

At this point, we acknowledge that the two basic concepts in physics, energy and space-time, are closely linked to geometry. If we look for an answer in geometry as to what these basic terms really mean, we will quickly become disappointed. Geometry as presented in **Hilbert's formalism**<sup>7</sup> is also based on a few primary terms, such as "point", "straight line", "plane (area)" and their relationships, which cannot be defined within this discipline. The explanation as to why we use them in geometry, and from there in physics, has to be found in the real physical world (**proof of existence**). The same applies to mathematics - it is based on the **theory of sets** (Cantor). The basic term "**continuum**", from which modern mathematics evolves, is defined as the set of all numbers, but it cannot be *a priori* explained. It is introduced in a circular manner through the concept of **number** (Frege), which in its turn is based on the theory of sets.

Within mathematical formalism one can prove that any **axiomatic system** can be transformed into another and vice versa. Beltrami and Klein were the first to obtain Euclidean models from Lobachevsky's non-Euclidean geometry and to demonstrate that geometry can be "arithmetised". The foundation of one axiomatic system with the help of another is a frequent formalistic method in mathematics, but it fails to give us a proof for the validity of the system. **Gödel's first theorem** proves that one can always find some *elementary statements* in a formal system that are apparently *true*, but cannot be deduced from the remaining statements of the system<sup>8</sup>. Gödel's theorem challenges the use of **finite** procedures, with which the validity of mathematics should be confirmed (Hilbert). This has led to a profound crisis, known as the "**foundation crisis**" of mathematics. Until now, nobody has been able to prove the consistency and validity of mathematics with mathematical means. The foundation crisis is on-going, but, unlike their predecessors, present-day mathematicians prefer not to take notice of it, as they are convinced that they are helpless on this issue.

From Gödel's theorem, it becomes evident that every known axiomatic system begins with a few elementary statements, usually called **axioms**. These so-called "**primary Gödel's statements**" have their source in **human consciousness** - they cannot be determined in a finite way by using secondary definitions that are also products of the mind. All secondary statements, which are derived from these primary statements by applying the principles of deductive logic, which postulates *inner consistency* and *lack of contradictions*, build the formalistic system of **mathematical axiomatics**. Purely for this reason, mathematics is regarded as a *hermeneutic* discipline of correct thinking. If we aim at establishing a general axiomatics of physics based on a single concept, we must bear in mind that this axiomatics should not only be

---

<sup>7</sup> Grundlagen der Geometrie, 5th ed., Leipzig & Berlin, 1922.

<sup>8</sup> K. Gödel, Über formal unentscheidbare Sätze der Principia Mathematica und verwandter Systeme, Monatsh. für Math. und Physik, 1931, p. 173-198.

*self-consistent*, but also *empirically verifiable*, that is, its validation should take place in the real physical world. This is the **proof of existence** that mathematics has failed to furnish yet - hence its on-going foundation crisis. Thus pure axiomatics and empiricism become a unity.

If we apply this knowledge gained from the theory of mathematics to physics, we come to the conclusion that neither “energy“ nor “space-time“ should be defined geometrically (in classical mechanics) or mathematically (in the theory of relativity and quantum mechanics) before they have been understood from an epistemological point of view. At present, all energetic and material interactions are regarded as solitary events that occur in the empty three-dimensional space of classical mechanics or in the still empty four-dimensional space of the general theory of relativity. As the theory of relativity is considered to be valid in classical mechanics, electromagnetism and quantum mechanics, the **emptiness** of space is a fundamental concept that affects all secondary ideas in physics. Physical space is the **vacuum**, where material or energetic events occur and can be experimentally observed. This is a basic paradigm of physics. Since most of the interactions in the physical world, such as gravitation or electromagnetism,<sup>9</sup> occur at a distance throughout the assumed empty space, the terms “**field**“ and “**long-range correlation**“ have been subsequently introduced.

Physical laws, such as the law of gravity, are considered valid independent of time and space scale<sup>10</sup>. The reason why physical laws are regarded as “scale-invariant“ lies in the assumption that space-time is *homogeneous*. The homogeneity of space-time is thus an aspect of its assumed emptiness.

The uncertainty surrounding the meaning of basic terms, such as energy, space-time, field, long-range correlation, homogeneity of space-time etc., extends throughout all ideas and concepts in physics. If the physical connotations of these terms prove to be false, the present scientific view of the physical world must change dramatically.

---

<sup>9</sup> In fact, gravitation and electromagnetism are the only interactions which we can directly observe. The other two forces, hadronic and weak forces are of theoretical nature. The experiments with which their existence can be confirmed are indirect. For instance, the registration of quarks by photography or any other method involves the first two forces. If we follow this logical line, we inevitably come to the conclusion that the results of any experiment are ultimately perceived by the mind - hence the priority of scientific consciousness over empirical experience in our axiomatics.

<sup>10</sup> Recently the invariance of Newton’s law of gravity has been questioned and a fifth force has been postulated. P.G. Bizzeti et al. Search for a composition-dependent fifth force. Phys. Rev. Letters, 1989, 62 (Nr. 25): 2901-2904; C. Jekeli et al. Tower gravity experiment: No evidence for a Non-Newtonian gravity, Phys. Rev. Letters, 1990, 64 (Nr. 11): 1204-1206 etc.

The **methodological analysis** of physics, which I performed after the discovery of the Universal Law, confirmed that the fundamental concepts of this science are not defined in an adequate and irrevocable manner. This precludes the establishment of a true physical axiomatics that leads to a unified physical theory. I came to the conclusion that, if we depart from the principles of mathematical formalism, it is possible to establish a completely new axiomatics of the present physical knowledge, which is based on a **single primary term**, and at the same time solve the *continuum hypothesis* that challenges the validity of mathematics by furnishing the missing *existence proof* in the real physical world.

The primary term of the **new axiomatics of physics and mathematics**, being a product of our consciousness, can be called “*energy*“, “*space-time*“, “*cosmos*“, “*universe*“, “*continuum*“, or “*being*“. The choice of the name is arbitrary - from an epistemological point of view, the name of the primary term is of no importance. All the possible names and symbols that can be attributed to the primary term, including the ultimate religious concept of “*God*“, are equivalent synonyms and can be exchanged without altering the validity of the axiomatic system<sup>11</sup>. This semantic equivalence should, however, be verified in the real world. This is the fundamental difference between a physical and a purely mathematical axiomatics. While the first operates with real objects the latter deals with “*objects of thought*“ (“*Gedankendingen*“, Dedekind). The primary objective of our new axiomatics is to show that all mathematical objects of thought, being essentially numbers and their relations (axioms and theorems), adequately reflect the primary physical term “*energy (space-time)*“, which is equivalent to the continuum - the set of all numbers. The latter is the basis of modern mathematics - the theory of sets. In this way, we can explain epistemologically why nature can be adequately described in terms of mathematics - for instance, why all known physical laws can be presented as mathematical equations. So far, this fundamental question, which must be placed at the beginning of every true empirical science, has evaded the attention of physicists.

---

<sup>11</sup> “As in a famous anecdote, Hilbert was keen to express this idea by saying that one could replace the words “*point*“, “*straight line*“ and “*plane*“ by “*table*“, “*chair*“ and “*beer mug*“ without changing any of the geometry.“ N. Bourbaki, *Elements of the History of Mathematics*, Springer, Berlin, 1991, p. 21.

## 2. THE FOUNDATIONS OF THE NEW PHYSICAL AXIOMATICS

### 2.1 PHILOSOPHICAL PROPAEDEUTICS

Every axiomatic system, such as geometry or mathematics, begins with a small number of fundamental terms, e.g. point, straight line, plane (area), continuum and number, and statements (axioms of relation), to which no further definition needs to be given. The information provided by these primary terms and their axioms of relations is *self-evident* and cannot be deduced from other statements by the application of finite procedures. We call such statements “**primary Gödel’s statements**“ or “**intuitive formalistic statements**“. Their truth can be proven secondarily by the development of a self-consistent axiomatics. The secondary statements of such axiomatics, e.g. *theorems* in mathematics, *natural laws* and their applications in physics and natural sciences, should explain or predict all empirical facts in physics and science without any occurrence of contradictions or paradoxes. We call such statements “**empirically verifiable statements**“. Both classes of statements build the foundations of the new physical axiomatics. Its application has no physical or intellectual limits. Departing from such an *operational* axiomatics, it is possible to develop a **General Theory of Natural Sciences**, which incorporates all known physical facts, as well as those still waiting to be discovered.

The key statements of the new axiomatics will be presented numerically. The only reason for this approach is to facilitate the establishment of relations between the statements. Although the chronological order given below follows inner logic, it is by no means strictly hierarchic. All statements, being derived from a single primary term, follow, directly or indirectly, the **principle of circular argument**, which is an application of the “**principle of last equivalence**“ for the parts. The latter principle reflects the fundamental property of the primary term - the **closed** character of energy (space-time). All secondary statements and terms of the new axiomatics are **U-sets** - they *contain* the primary term and themselves as an *element*. For instance, the aggregated set of all thoughts is also a thought (U-set). We may also call it “consciousness“ (semantic equivalence). The set of all physical systems is energy, space-time, universe, etc., but every material system, which has a mass also contains energy (see Einstein’s equation concerning the equivalence between mass and energy  $E = mc^2$ ) or space-time. According to the theory of relativity, all known systems are spatial and timely, although they are regarded geometrically as *mass points* or *particles* in classical mechanics.

From a neurophysiological point of view, consciousness is a particular energetic process within space-time (see vision below) that reflects space-time - all thoughts are spatial and involve time. Since the whole physical world is defined as energy (space-time), consciousness is simultaneously an equivalent

metaphysical reflection of the universe when the principle of last equivalence is applied (see point 2. below). As all secondary statements (thoughts) of the new physical axiomatics are U-sets and contain themselves as an element - the element being energy, space-time -, their validity is independent of the hierarchic order of their presentation. This insight “effects a great simplification in our outlook on the structure of the world”<sup>12</sup> and prevents the reader from unreflective criticism.

---

<sup>12</sup> B. Russell, *History of Western Philosophy*, George Allen & Unwin, London, 1975, p. 787.

## 2.2 INTUITIVE FORMALISTIC STATEMENTS

1. Any **axiomatics** is a product of *consciousness*. **Energy (space-time)** is the **primary term** of the new physical axiomatics. All other terms and their relations can be axiomatically derived from the primary term. The **primary axiom** (axiom of relation) of the new axiomatics is:

**Energy is equivalent to space-time.**

2. The primary term is “being“. All further names and symbols which can be used for “being“ as a totality (the set of all physical sets) are equivalent to the primary term. Frequent synonyms are: *universe, cosmos, world, nature, God, continuum* etc. This is called “**the principle of last equivalence**“. It reveals a fundamental *tautology* of all primary concepts. When the principle of last equivalence is applied to the parts it is called the “**principle of circular argument**“. The latter is the only operative principle of mathematics and physics - all physical quantities and mathematical terms are derived by the principle of circular argument.

3. **Consciousness** is a particular level (system) of energy (space-time) that has the capacity to reflect space-time and its own nature. All human thoughts involve space and time. The aggregated product of all thoughts is also a thought and can be called “consciousness“ (U-set). Consciousness is **metaphysical space-time**. According to the principle of last equivalence (2.), consciousness is equipotent to the primary term (1.). The **equivalence of the primary term** includes:

$$\begin{aligned} \text{Energy} = \text{Space-time} = \text{Consciousness} = \text{Universe} = \text{Cosmos} = \text{Nature} = \\ = \text{Continuum} = \text{Symbols} = \text{etc.} \end{aligned} \quad (3-1)$$

All other physical terms and statements can be axiomatically derived from the primary term through the principle of circular argument and reflect adequately the phenomenology of being. The new axiomatics complies with the principles of mathematical formalism (see below) and can be empirically verified. Below, we shall first present the basic statements and then deliver important physical proofs for their validity.

### 2.3 EMPIRICALLY VERIFIABLE STATEMENTS AND MATHEMATICAL DERIVATIONS

#### 4. Space-time<sup>13</sup> is **closed** and **infinite (boundless)**.

*Explanation:* The adjective “closed“ means that space-time is without a beginning and an end. The closed character of space-time is an *a priori* philosophical concept that is confirmed by all known physical phenomena (9.). The closed character of space-time is intrinsically linked to its infinity. All characteristics of the primary term assess its nature and are equipotent (2. & 18.). They are **U-sets** - they contain themselves, the primary term, as an element.

#### 5. Space-time is **continuous**, that is, it is without gaps of empty space, and **inhomogeneous (discrete)**.

*Explanation:* The *continuity (continuousness)* follows from the equivalence between energy and space-time (1.). As everything is energy (space-time), there is nothing that exists in between and is not energy or space-time. The “void“ = the „vacuum“ **does not exist**. It is a false concept in physics and should be eliminated from science once and for all. It is an **N-set**, also known as **Russell-set**. An N-set is the set of all elements that do not contain themselves as an element. All concepts in physics that are N-sets should be eliminated once and for all because they have no correlates in the real world.

Space-time is *inhomogeneous* because it appears in **constant amounts of energy**, known as **quants**<sup>14</sup> (12.). It is possible to construct an infinite number of **levels** and **systems** of energy (6.). These are *abstract* U-sets of the mind. For instance, the proton level consists of protons (systems) with the same constant energy. From an anthropocentric point of view, some levels are

---

<sup>13</sup> From now on, we shall speak of the primary term as „space-time“ or „energy“ - space-time being energy and vice versa. Only in cosmology, shall we use the synonym “universe“ with respect of tradition.

<sup>14</sup> The *quantization* of energy is basic to Planck’s equation  $E = hf$ , with which he first explained blackbody radiation and eliminated the ultraviolet catastrophe in Rayleigh-Jeans law. Einstein recognized that this quantization of radiant energy was not just a calculation device, but an imminent property of radiation, i.e., of the *photon level*. By explaining the photoelectric effect with the quantization of energy, he founded the new quantum mechanics. Bohr applied the idea of energy quantization to *matter* - he proposed an energy quantization model of the hydrogen atom, which was confirmed by the wavelengths of the radiation emitted by hydrogen. These key events in the development of modern physics reveal that energy (space-time) is *inhomogeneous*, that is, quantized. This is true for the energy of the photon level as well as the energy of matter (atoms). The consequences of this fundamental empiric knowledge have not been fully understood.

assessed as “matter“, others as “energy“. The levels are abstract mathematical categories with the “power of the continuum (space-time)“ - they are *infinite* (6. & 16.).

6. The U-set of equivalent constant amounts of energy is called a **level**. Each level with the power of space-time, e.g. the proton level, consists of an infinite number of *equivalent systems*. For example, all protons have the same energy, mass at rest and Compton wavelength. Vice versa: each system consists of an infinite number of levels and is part of other systems and levels. The systems and levels of space-time are U-sets and contain the primary term as an element.

*Explanation:* For example, the hydrogen atom level is the set of all hydrogen atoms in the universe. It is an abstract mathematical category. Since we do not know how many hydrogen atoms there are in the universe, we define them as “infinite“. The term “infinity“ is basic to mathematics, but, as its name suggests, it defies a finite definition. We will discuss this concept later in detail. Each hydrogen atom consists of different levels, such as electron levels, proton levels, quark levels etc. (U-sets). In Bohr’s model, there are many *stationary states (stable orbits)* of the electron that describe constant amounts of electron energy. Each of these stationary states is the basis for building a corresponding level. The same applies to the hadronic forces. As we see, the subdivision of space-time into levels and corresponding systems is arbitrary and indefinite. Since all levels and systems are U-sets and contain each other as an element, one can imagine infinite subdivisions of space-time. The capacity of human consciousness to build categorical systems of space-time is infinite. The infinity of space-time is *mental* and *real* at the same time. There is no possibility of distinguishing between an abstract infinity of numbers as objects of thought in mathematics and a real infinity of physical objects in space-time. Hence the mathematical character of nature - all physical laws are mathematical equations or functions (18.). Infinity is an intrinsic property of the primary term (4.) and all subsets with the power thereof (5.). All levels and systems defined in the mind have a physical correlate in the real world (U-sets).

7. All *levels* and *systems* of space-time are **open**. They exchange energy (space-time). We also say: “They interact.“ **Energy exchange** and **energy interaction** are synonyms.

8. Energy (space-time) is in a **permanent** state of energy exchange. The energy of a system or level is exchanged in the energy of another system or level and vice versa. The primary term energy (space-time) means “**energy, space-time exchange**“ (3.):

$$\text{Energy (space-time)} = \text{Energy (space-time) exchange} = E \quad (8-1)$$

The mathematical symbol for energy exchange is “ $E$ “. It is equivalent to the primary term (1. & 2.). According to the principle of last equivalence, this is also true for any other symbol, such as “ $\infty$ “ or “ $1$ “ that is assigned to the primary term (37.):

$$E = \infty = 1 = E / E = 1/1 = 1/\infty = \infty/1 = \infty/\infty = \text{any other symbol} \quad (8-2)$$

**9.** Energy (space-time) exchange is **conservative** - there is a *conservation of energy* (see first law of thermodynamics) because it is *closed* (4.). Space-time is **constant**, that is, it does not get lost (*perpetuum mobile* of the second kind).

**10.** The energy (space-time) exchange between the levels and systems is assessed by the **Universal Law = universal equation** (18.). The first law of thermodynamics is a static assessment of the Law.

**11.** The energy exchange  $E$  between the levels is arbitrarily called “**vertical exchange**“ and the energy exchange between the systems “**horizontal exchange**“. The energy exchange is at once vertical and horizontal, as all levels and systems are open (7.) and U-sets (15.). Only space-time is closed (4.).

**12.** The *elementary event* of energy exchange is called “**action potential**“. It is a *constant* amount of energy that is exchanged between the levels or systems. Each level and system has its own action potential. We define space-time as *inhomogeneous (discrete)* because it appears in constant amounts of energy (5.). **Inhomogeneity** and **discreteness** are synonyms. Like the definition of levels and systems, the definition of an action potential is a *voluntary* decision of the mind. There are infinite action potentials in space-time. The mathematical symbol of an (a)ction potential is „ $E_A$ “.

**13.** The action potential is the **basic** system (element) of the level. The level is the total set (sum, integral, aggregated product, U-set) of all action potentials of the level. The systems of this level are sets of the action potentials and subsets of the level.

**14.** The amount of energy of the action potential of a level or system  $E_A$  is **constant** in the mean:  $E_A = \text{constant}$ .

*Explanation:* Each elementary particle can be selected as the basic system of the corresponding level. In this case, we consider the elementary particle as an action potential (6. & 13.). For example, the proton is the basic system of the proton level. At the same time, we can regard this particle as an action potential of the level. All protons in the universe are considered to be equivalent - they have the same energy (at rest). All elementary particles fulfil the condition for being an action potential - they have a specific constant energy  $E = E_A = \text{cons}$ . The equivalence of the action potentials of a level is an

*abstract* definition (16. & 18.). In reality, all action potentials are approximately equal. They are equal in the mean<sup>15</sup>:  $E_A \cong cons.$

**15.** The levels and systems of space-time can be assessed with the *theory of sets*. The levels are real U-sets of well-defined elements with the *power of space-time (continuum)*. According to the theory of sets, they are infinite. The systems are subsets of the levels. The smallest subset of the level is defined as the **elementary action potential** (12., 13. & 14.). The levels, systems and action potentials are built according to the **principle of circular argument (Zirkelschlussprinzip)**<sup>16</sup>. The principle consists of two dialectic aspects: the *building of equivalence* and *relation*. The introduction of physical units (*measurement of physical quantities*) follows this principle (see SI system below). According to the principle of circular argument, a *real* physical system is randomly selected as a **reference system** or **unit** (building of equivalence). All units of the same quantity have to be equal, for example, all metre rules for the quantity “length“ are equal all over the world. The systems that should be measured are then compared with the reference system (building of relations). The principle of circular argument is also fundamental to the concept of number<sup>17</sup>. Purely for this reason the continuum, the set of all numbers, is the only adequate percept of space-time (energy) which mankind has

---

<sup>15</sup> The intermediate quantity of a set of quantities (see statistics below).

<sup>16</sup> The principle is also known as *circulus viciosus*. This connotation implies a negative epistemological aspect - when used for the parts (subsets of the primary term), this principle does not lead to true knowledge. We shall show that most of the definitions in physics, especially those of charge, mass, inertia etc., are of the vicious type. This fact explains why modern physics is unable to grasp the real meaning of these terms. The only correct application of the principle of circular argument is with regard to the primary term. In the new axiomatics, this application is called “the principle of last equivalence“ (see below). The axiomatic derivation of all subsets (levels and systems of space-time) from the primary term implicates the principle of last equivalence and eliminates the use of *circulus viciosus* in the definition of the parts. The epistemological advantage of this approach can hardly be overestimated - it has led to the discovery of the Universal Law and the integration of physics.

<sup>17</sup> While discussing the notion of truth in mathematics, the prominent advocate of the formalistic approach, N. Bourbaki, writes in his work “Elements of the History of Mathematics“: “In other words, the essence of mathematics - that illusive notion that could until then only have been expressed by vague names, such as “general rule“ or “metaphysics“ - appears as the **study of relationships** between objects that are only (**voluntarily**) known and described by *some* of their properties, precisely those that are put as **axioms** at the foundations of their theory.“ p. 20 (see also chapters 2.1 and 2.2).

developed up to now<sup>18</sup>. This is the point of departure for the unification of physics and mathematics (16. & 18.).

**16.** The **infinity** of space-time, energy, continuum is an aspect of the *openness* of its levels and systems (7.). It is a manifestation of *energy exchange* (8.). This immanent feature of the primary term is of a theoretical and empirical nature.

*Explanation:* From a theoretical point of view, human consciousness is an open system not only in terms of biology<sup>19</sup>, but also in a metaphysical sense, as it has the **degree of freedom** to define an *infinite* number of levels (sys-

---

<sup>18</sup> From an epistemological point of view, the system of mathematics, including its symbols for numbers and relations, can be substituted by any other system. This is partially done in the new axiomatics. Any new axiomatic system will always have its origin in the primary term. Any system with this property will be equivalent to mathematics. Therefore, there is no point in abandoning mathematics.

<sup>19</sup> All perceptions, like *vision*, function on the basis of energy exchange. For example, the photons of visible light with the energy  $E = hf$  reach the retinal cells (rods and cones), where they interact with *rhodopsin*, a trans-membrane protein of the photoreceptors, and trigger an action potential of the electromagnetic type  $E_A = E/f_c$  (repolarisation of rods and cones). This action potential is then transmitted by *neurotransmitters* and *neuromodulators* in the neuronal synapses (chemical energy) to the visual centre of the cortex where spatial perceptions occur. From an energetic point of view, vision is an energy exchange between the photon level, the electromagnetic level of the cells (modulation of the membrane potential of photoreceptors and neurons, described as inhibitory and excitatory action potentials) and the chemical energy level of intrasynaptic mediators, which are responsible for the activation or inhibition of postsynaptic action potentials in the neurons. It can be shown that all other perceptions are based on a similar energy exchange between the body and the external world or within the body (see vol. III). The distinct *qualities* which such perceptions evoke in consciousness can be regarded as a specific energy exchange between different levels of space-time. For instance, the various colours which we perceive as distinct intrinsic qualities of the objects correspond to photons with a specific frequency  $E = E_A f = h f_{\text{specific}}$ , but they are, nonetheless, of the same energetic origin - their frequencies may even partially or totally overlap, e.g. white light. The same is true for any other quality. The question, whether objects have distinct, immanent qualities as perceived by human senses, is central to philosophy since antiquity, but it has not been resolved either by the idealistic or the materialistic school. In the new axiomatics, there is no place for the traditional concept of distinct qualities such as colour, density, thickness and smoothness which pertain to objects. Although this outlook is central to common sense, these anthropocentric ideas can easily be substituted by the concept of energy exchange between different levels and systems of space-time. This novel view of the world eliminates most of the metaphysical prejudices and common places in philosophy and science.

tems). The creative potential of consciousness is infinite. The capacity of the mind to differentiate space-time in infinite permutations (differential calculus) and to integrate them in infinite sets (integral calculus) is based on the fact that space-time is closed (conservation of energy (4.)) and inhomogeneous (5.). Every system or level created in the mind has a physical correlate in the real world because space-time is closed and per definition the set of all U-subsets of the primary term. The objective existence of levels and systems of space-time is adequately reflected in the four basic mathematical operations and their further development, the *differential* and *integral calculus* (18.). It is remarkable that all continuum laws in physics<sup>20</sup> can be presented both in the differential and the integral form (see Hooke's law, Maxwell's equations of electromagnetism, wave function and Nabla- and Laplace-operators).

Even the structure of physics is subjected to the closed and inhomogeneous character of space-time. The individual physical disciplines are a mirror image of basic levels of space-time which are considered to be of practical relevance from an anthropocentric point of view. The structure of the other scientific disciplines follows the same pattern. So far, this fact has not been realized in the theory of science.

From an *empirical* point of view, the infinity of space-time is confirmed by the *incessant* creation and dissipation of real systems. All physical systems are *transient (temporary)* - they have a *finite* lifetime<sup>21</sup>. The term "dissipation" is a circumlocution for energy exchange, where one system is transformed into another and vice versa. The infinity of space-time lies in the dynamics of energy exchange (8.) - as space-time has only two dimensions (see below), its infinity is at once spatial and temporal (eternity). This is an axiomatic conclusion from the definition of one-dimensional space-time (21.).

17. The quotient of *energy exchange*  $E$  and *action potential*  $E_A$  is built by the principle of circular argument (15.) and is arbitrarily defined as "**absolute time**":

$$f = E / E_A \quad (17-1)$$

---

<sup>20</sup> We shall show that all known physical laws are *continuum laws* because they are derivatives of the Universal Law, while this law assesses the nature of the continuum or space-time (see chapter 3.2).

<sup>21</sup> For example, the proton was initially regarded as a stable particle until the Grand Unified Theory (GUT) postulated a finite lifetime of this hadron in order to integrate the weak, strong and electromagnetic forces. Any integration of forces presupposes an energy interaction, which is also a dissipation of forms. Because of the long lifetime of the proton, a decay of this particle has not yet been observed.

$f$  is a physical quantity without any *dimension* or *unit* - it is a pure number (relation), as both  $E$  and  $E_A$  are energy<sup>22</sup>. The new term “absolute time“ is directly derived from the primary term. If we arbitrarily set  $E = E_A$  (2. & 14.), we obtain for the absolute time  $f = 1$ .

*Explanation:* Absolute time can be assessed *traditionally* (*practically*) by various physical quantities<sup>23</sup>. The universal physical quantity of absolute time is *frequency*  $f = 1/t$ , hence the same symbol. Note: Our definition of absolute time does not involve the introduction of *conventional time*, which is *reciprocal frequency*  $t = 1/f$ . In terms of mathematical formalism, we can use any number, which is per definition a relation (quotient), as its reciprocal value without affecting the axiomatic character of the system. This is a very important lesson of the new axiomatics (see the derivation method of new absolute constants in chapter 9.9). Other important physical quantities of absolute time are *temperature*  $T$  and *Avogadro's number* (see section 5. on thermodynamics.).

**18.** The **mathematical presentation** of the **Universal Law** is derived directly from the primary term:

$$E = E_A f \quad (18-1)$$

The product of the *constant action potential*  $E_A$  and the *absolute time*  $f$  gives the amount of *energy exchange*  $E$ . This is the **universal equation** of the Law (1.).

We can use equation (18-1) for all levels and systems of space-time, as well as for the primary term: If  $E = E_A = \textit{space-time}$ , then  $f = 1$  (see the definition of the “certain event“,  $P(A) = 1 = f$ , in Kolmogoroff's theory of probabilities). The same is true for any action potential: if we define the system  $E$  as its own action potential  $E_A$ ,  $E = E_A$ , it follows that  $f = 1$ . We have again the definition

---

<sup>22</sup> It is important to observe that any quotient of two physical quantities with the same dimension(s) is a pure number. For instance, the area of a soccer field of 5000 *metres*<sup>2</sup> is in reality a *relation* - it is 5000 times bigger than the area of an arbitrary unit of 1 *metre*<sup>2</sup> (reference system). If we use another unit of distance, e.g. an inch, the relation between the soccer field and the area of 1 *m*<sup>2</sup> will be still the same - it is independent of the choice of the unit. The relation of the space-time of any two systems is thus a *constant* number, which is *independent* of the reference system (15. & 19.). It is a natural constant (see input-output model of the universe (26. & 29.) and the derivation method of new absolute constants in chapter 9.9). This insight is basic to a proper understanding of the new axiomatics.

<sup>23</sup> We must clearly distinguish between the axiomatic definition of (absolute) time and the practical measurement of this physical quantity. The latter involves arbitrarily defined units of measurement, such as *second* and *metre* (see below).

of the „certain event“. Thus the universal equation is an application of the primary axiom (1. & 2.) for the parts (15., principle of circular argument).

*Explanation:* The universal equation is a **rule of three**. Within mathematical formalism, it could be shown that all operations have their origin in the rule of three, that is, they have their origin in the Law. The universal equation can be presented alternatively as a *function*:  $y = ax = f(x)$ , where  $a = E_A = \text{cons}$ . All known mathematical functions can epistemologically be reduced to this primary function of space-time. The same applies to the theory of probabilities, which is based on the primary notion of the *probability set*  $0 \leq P(A) \leq 1$ . The latter is a mathematical transformation of the continuum (37., essay).

In the universal equation, energy exchange  $E$  is proportional to absolute time,  $E \approx f$ , because  $E_A$  is constant (14.).

Both the action potential  $E_A$  and the absolute time  $f$  are secondary subsets (U-sets) of the primary term; they are axiomatically derived from it and fulfil the principle of last equivalence (1. to 3.):

$$E / E_A f = 1 \quad (18-2)$$

The *universal mathematical symbol* with which the equivalence of the primary term is assessed is the **number “1“** (8-2). The number “1“ symbolizes the closed character of space-time (4.). We define such numbers as **closed** algebraic numbers. Mathematical consciousness has the degree of freedom (16.) to use the “one“ for the *whole* (universe, space-time), as well as for the *parts* (levels and systems). In this case, they can be defined as the “*certain event*“ in the theory of probabilities or as “1 *unit*“ in physics. Both approaches are equivalent from a formalistic point of view. Equation (18-2) can be presented alternatively as:

$$E = E_A f = 1 \quad (18-3)$$

As space-time is infinite, the “one“ is also a symbol of infinity  $1 = \infty$  (principle of last equivalence, 1., 2., 3. & 8.)<sup>24</sup>. The properties of space-time, energy, continuum are *infinity*, *closed character*, *inhomogeneity* and *continuousness* (4., 5. & 12.). These are immanent properties of the primary term and equipotent to it. Every property determines the other features and vice versa (U-sets). The principle of last equivalence is thus valid for any **adjective** of the primary term, as well as for their **symbols** - for instance, for the symbols that are used in mathematics (2.). We write the full equation of the primary term (see also equation (25-2)):

---

<sup>24</sup> For instance, many mathematical paradoxes are tackled by setting the number “1“ for infinity. In this case, this number is regarded as a *limit*, which is a circumlocution for the closed character of the primary term.

$$\begin{aligned}
& \text{Space-time} = \text{Energy} = \text{Energy exchange} = \text{Consciousness} = \text{etc.} = \\
& = \text{Infinity} (\infty) = \text{Closed character} (1) = \text{Inhomogeneity} (1/n^n) = \\
& = \text{Continuousness} (1/n \times n) = E = E_A f = E/E_A f = \\
& = 1 = \infty = n = 1/n^n = n^n/1 = 1/n \times n = \text{etc.} \tag{18-4}
\end{aligned}$$

$n$  stands for all numbers of the continuum, including all real and transcendental numbers. The number “1” is the origin of all rational numbers - they can be derived from this primary number by applying the principle of circular argument. When  $1 = 1$  (building of equivalence) and  $1 + 1 = 2$  (due to conservation of energy = closed character of space-time), then  $2 = 2/1$  (building of relation) etc. In this mode, all rational numbers of the continuum can axiomatically be introduced as ratios of integers. The series of irrational and complex numbers are then secondarily derived from the series of rational numbers by applying the principles of mathematical formalism. Thus the “one” is the origin of the continuum<sup>25</sup> not only in terms of the primary axiom (1. & 2.), but also with respect to the historical evolution of mathematics (see vol. I).

The primary term of the theory of sets, the continuum, is traditionally defined by the “infinite small number” (“das Unendlichkleine”) “ $1/\infty$ ” and the “infinite great number” (“das Unendlichgroße”) “ $\infty$ ”, respectively, “ $\infty/1$ ”. Remember: all numbers are relationships. “ $\infty$ ” is a symbol for infinity. The number “one” is also attributed to the universal equation (18-3). We write:

$$E = E_A f = \sum \infty \times \sum 1/\infty = \infty \times 1/\infty = 1 \tag{18-5}$$

From equation (18-5), we conclude that the continuum of all numbers is a correct intuitive notion of the primary term in mathematics. The **universal equations** (18-1) to (18-5) are iterations of the primary axiom by introducing new mathematical symbols for the primary term (1.). It must be clearly stated that mathematics is the prolongation of deductive logic by the use of abstract symbols, while logic itself comes from *Logos* (see Heraclitus’ idea of the Law). Mathematics is a hermeneutic discipline without an *external* object. For this reason, its validity cannot be confirmed with mathematical means (Gödel’s

---

<sup>25</sup> The idea of using the number “one” for the universe (continuum) is not new. It was anticipated by the last universal genius of modern times, Leibniz, and was later developed by Boole, the creator of modern symbolic logic. The present axiomatics is based on *three* new symbols, which have specially been developed for this purpose (38.). Together with the symbols, “1” and “ $\infty$ ” for infinity, they are sufficient to describe axiomatically all known physical laws and concepts. As we see, any axiomatics can flourish only after the creation of appropriate symbols.

theorem). The continuum hypothesis can only be solved in the *real* world (*existence proof*), and the real world is space-time. Although space-time is the origin of mathematics as its adequate perception, mathematics is a metaphysical *posterior* phenomenon, while space-time is the *a priori* entity - it is being (in German “das Sein“). As mathematicians always tend to forget this fact, one cannot repeat it often enough. This avoids a lot of misunderstanding. We now summarize the aforementioned statements:

The *universal equation*  $E = E_A f$  is the **mathematical “envelope“**, with which the nature of space-time (energy) is formalistically „wrapped“. Its properties are: *inhomogeneity*, *discreteness* (action potentials, systems and levels), *closed* character (conservation of energy), *continuousness* (energy = space-time, no vacuum), and *infinity* (incessant energy exchange). These properties are the primary concepts of mathematics (primary Gödel’s statements), from which this discipline evolves and not vice versa. In physics, we present the primary term as a **physical law**, which is a **mathematical equation** - hence the term “**Universal Law**“. The Universal equation is a *posterior* mathematical expression of space-time (continuum). All mathematical operations are ontologically derived from this **rule of three** - they reflect the nature of space-time.

For instance, the mathematical operations used in the universal equation, such as *addition (integration)* of the action potentials ( $\sum E_A$ ) or *multiplication* ( $E_A \times f = E$ ) assess the conservation of energy due to its closed character in a formalistic manner. This example illustrates the fact that all secondary notions and aspects of space-time are derived from the primary term in a circular manner (1. to 3.). This is the epistemology of the universal equation and all mathematical equations or functions (25.). The objective of physics is to fill this mathematical “envelope“ with an empirical content by assessing experimental data with the universal equation or a mathematical derivation from same. This is the theoretical part of any experiment.

Since the primary axiom of our axiomatics (1.) is a semantic equivalence (2.) that can be presented as an *equation: energy = space-time*, all physical laws, being derivations from the Universal Law, are also equations. This knowledge explains why nature can adequately be described in terms of mathematical equations. Physics has not been able to answer this question - it does not even see any necessity in questioning the mathematical character of the physical world. It takes it for granted - as a “free lunch“ and a privilege of this discipline - hence its cognitive ignorance.

**19.** The only possible definition of *physical quantities* of space-time and their *units* is the **method of measurement**. All methods of measurement are *circular* (15.). Every method of measurement is based on the arbitrary choice of a

**reference system** of units (15.). The unit(s) of the reference system, which is always a *real* system of space-time, are symbolized with the number “1” and designated with the name of the unit “1 *unit*“, e.g. 1 *metre*, 1 *second*, 1 *joule* etc. This traditional expression of physical quantities is a pure convention and can easily be eliminated in the new axiomatics (see below). Thus every method of measurement is **part of mathematical formalism**. For instance, we can assign the actual space-time of a system or a quantity thereof the primary number “1” and define it as 1 *joule*, 1 *ampere*, 1 *coulomb*, 1 *henry*, 1 *hertz*<sup>26</sup>, and then compare the other systems with it. Any measurement of a real system is a **circular comparison** that is based on the *mathematical method* (geometry, algebra, statistics, differential and integral calculus, etc.). The physical quantities, as defined by this method of measurement, do not have any transcendental meaning beyond the definition of their units.<sup>27</sup>

*Explanation:* We shall prove that the seven basic physical quantities (dimensions) and their units (24.) can be derived from the two quantities, dimensions of space-time - *space* and *time*. These two quantities are dialectical *constituents* of the primary term (21.).

Under the term “method of measurement“ we understand all empirical experiments, including the theoretical and mathematical evaluation of their data. There is no experiment which does not involve a reference system and a method of measurement. All validated experiments have a mathematical basis, otherwise they cannot be reproduced. The method of measurement is a synonym for the *empiric method*, but it also includes the theoretical part. It is the set of all possible methods, with which space-time and its systems and levels are assessed. Some fundamental methods are: the *counting* (enumeration, calculation, including the basic operations, addition, subtraction, multiplication and division, as well as differential and integral calculus), the *measurement* of spatial dimensions (geometry, topology), and *statistics* (the theory of probabilities, which can be deduced from the counting operations). It is noteworthy that all physical laws and their applications can be expressed by the aforementioned methods.

---

<sup>26</sup> It is, indeed, remarkable to what extent physics has been populated with the names of physicists, which stand for various physical quantities and their units. Unfortunately, these have been defined in an abstract mathematical way from the primary term, before they have been introduced in practice by their method of measurement. As all these “physical memorials“ are abstract U-subsets of space-time, we eliminate them in the new axiomatics as *distinct* physical entities (see below).

<sup>27</sup> This conclusion is of paramount importance with respect to the endless and highly speculative discussion on the nature of conventional time (for instance, whether time is reversible or irreversible). The only possible definition of time is its method of measurement (24., essay).

The empirical part of the method of measurement is an *energy interacton* with the system(s) under observation (7. & 8.)<sup>28</sup>. Every experiment has an instrument or a calibrated device<sup>29</sup>, that is, it is *standardized* (building of equivalence) and an object or subject, with which it interacts (building of relations, comparison). As we see, the method of measurement complies with the principle of circular argument (15.). This is an aspect of the closed character of space-time (4.).

Every experiment can formally be regarded as an **interaction between two real physical entities** (systems, levels and action potentials) - in this particular case, between the object under investigation and the device of investigation (U-sets). We shall prove that every energy interaction in space-time, including any experimental interaction, is an energy exchange between two entities that can be described by the Universal Law<sup>30</sup>. This is called the **axiom of reducibility**<sup>31</sup> (42). With this operative axiom, we shall explain the ontology of all physical laws - how they dynamically evolve from consciousness and acquire the form of mathematical equations.

**20.** Energy (space-time) *exchange* is assessed by human consciousness as **motion (displacement)**. Motion is the manifest feature of energy exchange. The *universal* physical quantity<sup>32</sup> of motion is **velocity (speed) v**. From the velocity, one can obtain further physical quantities of movement, such as *acceleration a* or *gradient (potential) U* (43.), by applying the rules of mathematical formalism, e.g. differential or integral calculus (16. & 24.):

---

<sup>28</sup> If there are several systems under observation, they can be aggregated to one system, as all systems of space-time are U-sets. The same applies to experimental instrument(s) or device(s). As they are real physical systems, i.e., they are U-sets of space-time, they can be aggregated to one system (conservation of energy due to the closed character of space-time).

<sup>29</sup> The device can be a standardized test as in clinical and psychological research. In this case, the interaction with the subject is mental (metaphysical), but it still follows the Universal Law, which is a primary idea of the mind.

<sup>30</sup> If we develop this idea to its logical end, we inevitably come to the conclusion that every experiment is a **tautology** of the Universal Law in the concrete experimental condition. It is cogent that this insight will profoundly affect our view on experimental research.

<sup>31</sup> This term was first introduced by Russell and Whitehead in their fundamental work "Principia mathematica" (1910-1913), where they developed a logical system of hierarchical types, similar to the present axiomatics.

<sup>32</sup> Physical quantity is called in German "physical observable" as a noun. It is a pity that this term is not common in English because it already implicates the abstract, mathematical character of this word - physical observations imply a mathematical assessment, while the term "quantity" evokes the wrong idea of an immanent property.

**The fundamental physical quantity of energy (space-time) exchange is velocity.**

This basic conclusion is the key to an understanding of the epistemological background of the Universal Law and its expression in the new axiomatics (21. to 28.).

**21.** The **velocity** itself is not an indivisible quantity. It consists of two further quantities which build a quotient (relationship)<sup>33</sup>.

*Explanation:* Traditionally, velocity is presented as the quotient of *displacement (distance) s* and *conventional time t*:  $v = s/t$ . In physics, the displacement of an object is assessed geometrically. In classical mechanics, the method of measurement (19.) is Euclidean space. The displacement is presented as a *distance* or a *vector* when the direction is considered<sup>34</sup>. Both quantities are **one-dimensional space**. We designate this quantity in our axiomatics as: [1d-space]. This symbol can be applied to any kind of line, such as straight line, elliptic line, circle line (circumference) etc. This formalistic presentation of space quantities takes into consideration the traditional geometric approach in physics. It is applicable to any kind of space. In 3d-Euclidean space *surface (area)* is presented as [2d-space] and *volume* as [3d-space]. As we show throughout this book, this approach produces a considerable simplification in the presentation of physical quantities. The symbol is of universal application. If we write it in the general form [nd-space], where  $n =$  all numbers of the continuum, we can use this symbol for any kind of space, such as fractal space, tensor space or  $n$ -dimensional space (see string theory). A common [1d-space]-quantity in physics is the *wavelength*  $\lambda$ .

We have shown in point 17. that reciprocal time  $1/t$  or frequency  $f$  are actual quantities of absolute time when the method of measurement is applied (19.). If we depart from the conventional method of measuring velocity, which is at the same time the only relevant definition of this quantity, we arrive at the following axiomatic presentation:

---

<sup>33</sup> All physical quantities are relations. This follows from the method of their measurement. As all numbers are also relationships, any physical quantity can be presented as a number. In this way, the physical world (space-time) can be presented as a numerical model of relationships. This model is equivalent to the continuum (chapter 9.9) - hence the equivalence between physical space-time and mathematical continuum.

<sup>34</sup> This volume predicates the reader's competence in physics. Although it follows the common didactic pattern of physical presentation in traditional textbooks, it is not designed as an introduction to physics. For this purpose I recommend the standard textbook for scientists and engineers, written by Paul A. Tipler (Physics, Worth Publishers, New York, 1991). I will refer to this book, whenever I present the conventional point of view. However, this textbook can be substituted by any other standard textbook on physics, which is a highly canonical science.

$$v = [1d\text{-space}] \times f = [1d\text{-space}] \times [absolute\ time] = [1d\text{-space-time}] \quad (21-1)$$

As we see, this formalistic mathematical presentation of velocity begins with the empirical assessment of motion and ends up in a *self-consistent* manner with the primary term (closed character of space-time). Motion is the universal manifestation of energy exchange. This is a basic truth, not only in Greek philosophy (*pantarei*), but also in the theory of relativity. Thus motion is an equivalent property of the primary term (18-4). Hence the following fundamental definition:

The product of one-dimensional space [*1d-space*] and absolute time *f* results in a quantity, called “**one-dimensional space-time, [1d-space-time]**“. *Space* and (*absolute*) *time*<sup>35</sup> are called “**constituents**“ of the primary term.

A major objective of this book is to show that all physical quantities and their relations, which are described in terms of physical laws, can be deduced from the primary term. As most of the concepts in physics have evolved from a single experience to a generalized form<sup>36</sup>, the aim of this book is to prove that an *a priori* intuitive idea of the Universal Law has pre-determined in a disguised form every scientific explanation of the physical world.

At this point, it is extremely important to draw the attention of the reader to a fundamental fact that has not been comprehended yet. By introducing the concept of “spatial dimension“ in the new axiomatics, we only follow the historical tradition in physics. This approach allows a simple transformation of all known physical laws into the new [*space-time*]-symbolism. We do not assert that space-time has any dimensions. Space-time is **dimensionless**, it is being - it has an objective existence that is independent of the existence of human consciousness, while the latter is undoubtedly a recent and local phenomenon in the universe. The concept of “spatial dimensions“ has evolved within the system of geometry and mathematics and is therefore of secondary character. We must explicitly state that space-time is an *entity*, which does not contain any anthropocentric terms - it is, so to speak, “**termless**“. It is a

---

<sup>35</sup> From now on, we shall speak only of „time“ and mean „absolute time“ *f*. When we use conventional time *t*, we shall mention this explicitly.

<sup>36</sup> As a classical example in this respect, we shall discuss Galilei’s experiments on gravitation in chapter 9.9. His modern quantitative description of projectile’s motion was generalized by Newton to a *law of gravity*. To achieve this generalization, Newton had to introduce the static *Euclidean space*, which is a pure geometric formalism. As geometry is a particular system of mathematical formalism that can be substituted with any other axiomatic system, e.g. with algebra (Beltrami & Klein), it is cogent why we must develop a general axiomatics of physics and mathematics if we want to unify this empirical discipline into a coherent theory.

privilege of human consciousness to populate space-time with abstract terms (see footnote 22.). The more exactly these terms reflect space-time in its inhomogeneity (variety of forms), the more easily can they be verified - hence the priority of mathematics over natural sciences. In addition, the exactness of our mental perception of the external world is inherent to our efforts to transform space-time according to human needs. Technical progress is an energy exchange. This is the eschatology behind human pursuit of knowledge and any scientific endeavour. The ultimate goal of this endeavour is the survival of the human race as a trans-galactic species. The other alternative is extinction. The outcome is open. Back to physics, it is essential to know that it is up to human consciousness to introduce as many spatial dimensions as possible, in order to describe space-time. The degree of freedom of consciousness is in this respect infinite (16.)<sup>37</sup>. It is worth mentioning that neither geometry, nor topology, has produced a coherent explanation of what a “geometric dimension“ really is. As with all basic terms in geometry, mathematics and physics, this term evades a finite definition. All basic terms can be explained only with the nature of space-time.

The arbitrary choice of the number of dimensions that can be projected onto space-time implicates an **equivalence** between the different geometric approaches, with which the primary term is described (principle of last equivalence, 2.):

$$E = v = [1d\text{-space-time}] = v^n = [nd\text{-space-time}] = \text{cons.} = 1 \quad (21-2),$$

where  $n = \text{all numbers of the continuum}$

**22.** Energy (space-time) is **constant:  $E = 1 = \text{cons.}$**  because it is closed (4.). The same applies to its levels - they have the power of the continuum (5.). Each level can be considered as its own action potential with a constant energy (5. & 14.). The same is true for any system. Although the systems are open, they have a specific *constant* space-time, which is a manifestation of the closed character of space-time through its parts (U-subsets). The constant character of space-time is manifested by any actual quantity of space-time. For instance, the velocity  $v_{En}$  of a particular level is constant (20. & 21.). We shall

---

<sup>37</sup> An analysis of the numerous scientific journals on physics and applied physical mathematics confirms that the major intellectual preoccupation of physicists at present is the introduction of new physical spaces and the solution of old problems with new mathematical instruments instead of grasping nature with a fresh look. The number of spatial dimensions applied to the physical world has grown exponentially in the last years and parallel to it - the confusion in physics. Unfortunately, one cannot reach the ultimate truth by producing a growing mathematical complexity, but only when one dismisses the bewildering variety of confounding concepts in science and goes back to Descartes' origin of knowledge - “cogito ergo sum“.

present many proofs for this axiomatic conclusion in the present volume. Since we can assign the number “one“ to each level or system (18-5), we acquire the equation of space-time (21-2) for any subset of the primary term:

$$v_{En} = [1d\text{-space-time}] = [1d\text{-space}]f = \infty \times 1/\infty = \text{cons.} = 1 \quad (22-1)$$

*Examples:* The *velocity of light*  $c$  is a one-dimensional quantity of space-time of the photon level:  $c = [1d\text{-space-time}]_p = \text{cons.}$  For this reason it is a constant. Until now physics has been unable to present an explanation why the speed of light should be constant. Every  $n$ -dimensional quantity of the photon level is constant. We shall show that the *universal potential* of the photon level  $U_U = c^2$ , called “long-range correlation“ in the new axiomatics (43. & 44.), is also a constant quantity.

**23.** From the axiomatic definition of *one-* or *n-dimensional* space-time (21. & 22.), we conclude that both constituents of space-time - *space* and *time* - are **canonically conjugated, reciprocal** quantities which build the **unity** of space-time. From equation (22-1), it follows that space tends towards infinity [**space**]  $\rightarrow \infty$ , when time tends towards the “infinite small number“  $f \rightarrow 1/\infty$  and vice versa.

The new axiomatic definition of velocity as obtained from the primary term (equations (21-2) & (21-3)) leads to the following fundamental realization about the behaviour of space and time:

The larger the space of a system or level, the smaller its time  $f$  and energy  $E$ , respectively, its force ( $F = E/s$ ), as  $E \approx f$  and  $f = 1/[space]$  and vice versa (18.)

*Explanation:* As space-time is closed and consists of U-subsets, there is no such thing as the “infinite small“, or the “infinite big“. All actual values of space and time of the systems or levels under observation are **finite** mathematical relationships (circular argument). All natural constants and quantities are finite numbers. Based on the fundamental characteristics of space and time, namely, their reciprocity, we eliminate once and for all the *infinities* that occur in theoretical physics. These are excluded nowadays by the so-called “renormalization“.<sup>38</sup> “Infinity“ as a concept is only valid for the primary term.

---

<sup>38</sup> R. Feynman, the founder of QED, discusses in his book „QED, The Strange Theory of Light and Matter“ (Penguin, 1985, p. 127-28) the problem of infinities in physics and the efforts to solve same: “The problem is, when we try to calculate all the way down to zero distance, the equation blows up in our face and gives meaningless answers - things like *infinity*. This caused a lot of trouble when the theory of quantum mechanics first came out...The shell game that we play... is called “renormalization“. But no matter how clever the word, it is what I would call a dippy pro-

It is a philosophical idea. All physical relations of the systems and levels of space-time are finite instead. This is the fundamental difference between the whole and its parts: the whole is *closed* and *infinite*; the parts are *open* and can be described in terms of *finite relationships*.

The finite character of all physical relations is closely linked to the use of the number “1“, for instance, as “1 *unit*“ of a certain quantity in the SI system that can be experimentally determined. We shall show that the “one“ and the set of all *real* numbers, which are derivatives from the “one“, are *closed* numbers. Closed numbers allow the building of *finite* relationships. If we substitute them by the so-called *transcendental* numbers, which we define as *open* numbers, for example, the famous transcendental number “proportio divina“ has infinite approximations (Fibonacci series), we come to the conclusion that all finite relationships in physics are *mathematical approximations* of the transcendental (infinite), open character of real levels and systems of space-time (see below). The real numbers are arbitrary limits of the transcendental numbers, which can be presented by infinite approximations, for instance, the closed real number “3.14“ is one possible approximation of the open transcendental number  $\pi$ , which is a relationship of two geometric lengths  $\pi = u/d$ . It is extremely important to realize that all numbers given to physical quantities, e.g. to natural constants, are expressed as closed real numbers, and never as transcendental (infinite) numbers. The reason for this is that mathematics has virtually no method of how to use transcendental numbers for practical applications.

Finally, the number “one“ has a crucial role in the mathematical presentation of the **reciprocal behaviour** of space and time:

$$E \approx f = 1 / [1d\text{-space}] \quad (23-1)$$

We must acknowledge that at present we do not have any other formal method of describing reciprocity, be it mathematical or physical, but use the “one“ (37).

*Examples:* The *reciprocity* of the two constituents of space-time - space and time - is a fundamental discovery of the new axiomatics. Although it has been anticipated by the theory of relativity, the full consequences of this fact have not been realized. This immanent property of the primary term is confirmed by all experimental facts without any exception. The greatest energy is found in the strong nuclear forces, also known as hadronic forces. At the same time, the nuclei (protons and neutrons) and their elementary particles, the quarks, have the smallest extent (volume). Gravitation is the weakest force - hence the greatest spatial extent of gravitational objects in the universe.

---

cess! Having to resort to such hocus-pocus has prevented us from proving that the theory of quantum electrodynamics is mathematically self-consistent.“ The self-consistency of physics and mathematics is accomplished for the first time in the new axiomatics by solving the *continuum hypothesis* in the real physical world.

Gravitation and extent of objects are reciprocal magnitudes, e.g. *white dwarfs* versus *red giant stars*. When gravitation becomes maximal, as is the case with *black holes*, there is a space singularity. The reciprocal behaviour of energy and space is without any exception. This is the key message of the theory of relativity: *Lorentz transformations* (*time dilution* and *FitzGerald length contraction*) reflect the reciprocal character of space and time for all systems. This is evident from the fact that the theory of relativity is valid not only for the macrocosm, but also for the microcosm - for instance, it is part of QED and QCD.

**24.** The two constituents of space-time - *space* and *time* - **are the only physical dimensions** of the primary term.

*Explanation:* The conventional space-quantities, such as *length*, *displacement*, *distance*, *circumference* and *wavelength*, are summarized in the new axiomatics under the geometric term [1*d-space*]-quantity. Space can also be presented as *area* - [2*d-space*]-quantity (21.). Frequent [2*d-space*]-quantities in physics are the *charge* and the *magnetic moment*. This will be proven in section 6. Another common presentation of space is *volume*, which is a [3*d-space*]-quantity. All these presentations are introduced within geometric formalism and can be enriched by any [n-*d-space*]-presentation, where *n* is the set of all numbers. We conclude:

**Geometric formalism** is the method of definition and measurement of all spatial quantities (19.). All spatial quantities are relationships which are built by the principle of circular argument and can be presented as *dimensionless* numbers.

The same applies to the conventional physical quantities of absolute time *f* - the other constituent of space-time (17.). Its actual quantities, such as *frequency*, *reciprocal time* and *temperature*, are numerical relationships (see below). Like space, the only possible definition of time quantities is their method of measurement, which is mathematics.

**All other physical quantities are composed** of these two constituents within mathematical formalism - **they are axiomatically derived from the primary term.**

Physical quantities do not have a “distinct“ existence outside consciousness. They are *abstract* U-subsets of the primary term, which is the only real thing. Their method of definition is *mathematics*. It is also the method of their *measurement*. Like the numbers with which they are expressed, physical quantities are “objects of thought“; they are not part of the physical world, as is believed in present-day physics.

This will be proven in detail in the present volume. This insight allows the **axiomatization** of all physical terms (see Table 2). As all known physical laws assess relationships between different abstract quantities, it is possible to unify all physical laws - they appear to be **derivatives** of the Universal Law. Such equations assess the nature of space-time in mathematical terms. Thus the new axiomatics is **experimentally verifiable**:

**All** physical and other empirical experiments **confirm the Universal Law** in their *particular conditions*. There is no experimental evidence that infringes upon the Law. The new axiomatics is instrumental in bringing about the unification of experimental and theoretical physics.

### Essay: Systems of Measurements and Units in Physics

“The laws of physics express *relationships* between physical quantities, such as length, time, force, energy and temperature. Thus, the *ability to define* such quantities precisely and measure them accurately is a requisite of physics. The measurement of any physical quantity involves *comparing* it with some precisely defined *unit value* of the quantity.”<sup>39</sup> This is the departing point of any intellectual effort in physics. In this essay we shall explain why the “ability to define“ physical quantities appears to be the “Achilles heel“ of modern physics.

The mathematical expression of any physical quantity consists of a *number*, which is a relationship between the magnitude of the quantity and the arbitrarily chosen unit for this quantity, and the *name of the unit*. If a distance, e.g. the length of a soccer field, is 100 times longer than 1 *metre* (length unit of choice), we write for it “100 *metres*“. The magnitude of any physical quantity includes both a number and a unit. This presentation is a pure convention. All physical quantities can be expressed in terms of a small number of fundamental quantities and units. Most of the quantities in physics are *composed* quantities within mathematical formalism. This is generally acknowledged. For example, speed is expressed as a relationship of a unit of length (*metre*) and a unit of conventional time (*second*)  $v = s/t$  (*m/s*). The most common physical quantities, such as *force*, *momentum*, *work*, *energy* and *power*, which are basic to many physical laws, can be expressed with only three fundamental quantities - *length*, *conventional time* and *mass*.

The set of all standard units in physics is called “Système Internationale“ or **SI system**. It consists of a few basic quantities and their corresponding units, from which all other quantities and units can be derived by applying the method of mathematical formalism (method of definition = method of measurement).

---

<sup>39</sup> PA Tipler, p. 2

These are: (1) length (*metre*), (2) conventional time (*second*), (3) mass (*kilogram*), (4) temperature (*kelvin*), (5) amount of substance, also called “the mole” (*mol*), (6) current (*ampere*) and (7) charge (*coulomb*)<sup>40</sup>. The last two quantities are defined in a circular manner, so that they can be regarded as one quantity.

A major objective of this volume is to present theoretical and experimental evidence that these six fundamental quantities are axiomatically derived from the two constituents of space-time - space and time (21.). As the other conventional quantities used in physics are known to be derivatives of these few quantities, this is also true for any new physical quantity. This is a fundamental proof that space-time has only two constituents, quantities, dimensions (synonyms). By way of introduction, we begin with the definition of the SI units of space and conventional time, *metre* and *second*. The definition of these quantities is at the same time the method of measurement of their units (19.).

The standard unit of length ([1*d-space*]-quantity), 1 *metre* (1*m*), was originally indicated by two scratches on a bar made of platinum-iridium alloy kept at the International Bureau of Weights and Measures in Sèvres, France. This is, however, an indirect system (a surrogate) of standard length. The actual system of comparison is the arbitrarily chosen distance between the equator and the North Pole along the meridian through Paris, which is roughly 10 million metres. Thus the earth is the initial, real reference system of distance - the metre is an anthropocentric surrogate. As this gravitational system of reference length was found to be inexact, the standard metre is now arbitrarily defined with respect to the speed of light. This quantity is defined in our axiomatics as [1*d-space-time*] of the photon level: it is the distance travelled by light in empty (?) space during a time of 1/299,792,458 *second*. This makes the velocity of the photon level  $c = 299,792,458 \text{ m/s}$ . The photon level of which the visible light is a narrow spectrum (a system) has a constant velocity  $c$ . This has been deduced in the new axiomatics from the primary term (22.) and confirmed by the theory of relativity and physical experience. The universal property of all levels of space-time - their constant specific velocity as the universal manifestation of energy exchange (20. & 21.) - is intuitively considered in the conventional definition of the SI unit of length, 1 *metre*. So far, this fact has not been apprehended. Through the standard definition of space and conventional time (see below), the velocity of the photon level is voluntarily selected as the *universal* reference system of space-time (19.), to which all other physical systems are set in relation (method of measurement).

The standard definition of the length unit reveals a fundamental epistemological fact that has evaded the attention of physicists. The present standard definition of 1 *metre* by using the speed of light gives the impression of being clear-cut and unambiguous. In fact, this is not the case. The definition of this length unit is based on the principle of circular argument and involves the

---

<sup>40</sup> Some authors believe that *candela* (*cd*) is also a basic unit, but this is a mistake.

definition of the time unit, 1 *second*. If the latter unit could be defined in an *a priori* manner, all would be well. When we look at the present definition of the **second**, which is at the same time the only possible definition of the quantity “conventional time“, we come to the conclusion that this is not possible. The standard unit of time, being originally defined as  $1/60 \times 1/60 \times 1/24$  of the mean solar day, is now defined through the *frequency* of the photons emitted during a certain energy transition within the caesium atom, which is  $f = 9,192,631,770$  per second. In this case, we have again a concrete photon system with a more or less constant frequency, which has been arbitrarily selected as a reference system of time measurement. From this real reference system of space-time, an *anthropocentric surrogate* - the *clock* with the basic unit of 1 *second* - has been introduced. The conventional time of all events under observation is then compared with the time of the clock. Thus the measurement of time is in reality a comparison of the frequency of events that are observed with the frequency (periodicity) of a standard photon system. The method of definition and measurement of the quantity “conventional time“ and its unit, 1 *second*, is therefore a **circular comparison of actual periodicities**. Such quantities are pure (dimensionless) numbers.

However, any experimental measurement of photon frequency involves the measurement of length - the actual quantity of time cannot be separated from the measurement of the wavelength  $\lambda$ , which is an actual [1d-space]-quantity. The two constituents of space-time **cannot** be separated in real terms because they are **canonically conjugated**. The equation of the speed of light  $c = \lambda f$  is intrinsic to any measurement of photon frequency and wavelength. Neither wavelength, nor frequency, can be regarded as a distinct entity - they both behave **reciprocally** and can only be expressed in terms of space-time (21.):

$$c = \lambda f = [1d\text{-space}] f = [1d\text{-space-time}]_p \quad (24-1)$$

The wavelength and frequency of photons are the actual quantities of the two constituents, space and time, of this particular level of space-time. The measurement of any particular length [1d-space] or time  $f = 1/t$  in the physical world is, in fact, an indirect comparison with the actual quantities of space and time of a **photon system of reference**. The introduction of the SI system obscures this fact. We conclude:

The one-dimensional space-time of the photon level [1d-space-time]<sub>p</sub> is the **universal reference system** of length  $s = [1d\text{-space}]$  and conventional time  $t = 1/f$ , and their units, 1 *metre* and 1 *second*. The *SI system* is an anthropocentric surrogate of this **real** reference system.

This conclusion is of immense importance - we shall show that the theory of relativity uses the same intrinsic reference system to assess *relativistic space*

and *time* of kinetic objects. *Lorentz transformations*, with which these quantities are presented, are relationships (quotients) of the space-time of the object in motion as assessed by  $v$  with the space-time of the photon level as assessed by  $c$ . These are formalistic constructions within the system of mathematics. We shall show that these quotients belong to the probability set  $0 \leq P(A) \leq 1$  and can be expressed in terms of statistics (43.).

From this survey, it becomes evident that the physical quantities, length and conventional time, and their basic units, *metre* and *second*, are defined in a *circular* manner by the arbitrary choice of a *real* reference system of space-time - in this particular case, of **photon space-time**. The SI system is an epiphenomenon; it is a human convention and can be substituted by any other system through the introduction of *conversion factors*. This also applies to the other four basic quantities and their units. The definition of any physical quantity **cannot be separated** from its method of measurement, which is mathematics. The latter is, at the same time, its *method of definition*. Physical quantities as defined in physics **do not have a distinct existence in the real world**, but are intrinsically linked to their definition, which is a product of consciousness. As any axiomatics is also a product of consciousness (1.), the derivation of all known physical quantities from the primary term is essentially a problem of a correct organisation of physical and mathematical thinking and not a problem that should be resolved through explorative empiricism.

Thus every method of measurement and every definition of a physical quantity are based on the principle of circular argument (15.). This epistemological result of our methodological analysis of physical concepts is of universal character. The explanation is very simple: as every physical quantity reflects the nature of space-time as a U-subset thereof, its definition has to comply with the principle of last equivalence (1. & 2.). This fundamental axiom of the new axiomatics is intuitively perceived by the physicist's mind and is put forward in all subsequent definitions of physical quantities. As these terms are of secondary character - they are parts of the whole -, the actual principle applied in physical definitions nowadays is *circulus viciosus*. The vicious character of this principle when applied to the parts and the simultaneous negligence of the primary term explain why the existence of the Universal Law has been overlooked in the past. Physics has produced in a vicious circle a large number of concepts, which are either synonyms or partial perceptions of the primary term. Unfortunately, they have been erroneously regarded as distinct physical entities. This has given rise to the impression that these physical quantities really exist. In fact, they only exist as abstract concepts in the physicist's mind and are introduced in experimental research through their method of measurement (19.). Space-time is **termless** - it is an *a priori* entity; the human mind, on the other hand, is a local, particular system of recent origin that has the propensity to perceive space-time and describe it in scientific terms. Science originally means „knowledge“, but it also includes the organisation of knowledge - every science is a **categorical system** based

on the primary concept of space-time. Only the establishment of a self-consistent axiomatics which departs from the primary term of space-time leads to an insight that there is only one Law of nature and allows a correct organisation of human knowledge on the basis of present and future empiric data.

**25.** Departing from the definition of one-dimensional space-time (21.), the universal equation, which is a rule of three, can be expressed in many different ways within the framework of mathematical formalism. All possible mathematical presentations are *equivalent* (1.). Some common derivations in physics are:

$$E = E_A f = E_A v/s, \text{ or } E s = E_A v \text{ or } E/v = E_A/s \quad (25-1)$$

The **general** mathematical expression of the *universal equation* is:

$$E / E_A f = E^n / E_A^n f^n = 1 \quad (25-2)$$

*Explanation:* Every mathematical equation (function) has its origin in the nature of space-time. It reflects the closed character, conservation and inhomogeneity (discreteness) of space-time (18-4). Every mathematical equation can be derived from the primary axiom of the new axiomatics, stating the *equivalence* between energy and space-time (1.). When applied to the parts, any mathematical equation reflects the *constant* amount of energy exchange (12., 13. & 14.). In this respect we should take into consideration that any system or level of space-time can be regarded as its own action potential, which is a specific constant energy package (degree of mathematical freedom, 16.). The closed number "1" can be attributed to the primary term or any subset of same (18.). From this we conclude that the universal equation can be presented as a mathematical function that contains an *infinite* number of variables:

$$y/(a^n x^n \dots + \dots a^{n-m} x^{n-m}) = 1 \quad (25-3),$$

where  $m = 1, 2, 3 \dots n$

Each mathematical variable corresponds to a physical quantity. Within mathematics each variable can be presented as a product of differential or integral calculus, or a probability P(A). We conclude:

**The Universal Law (universal equation) is the origin of mathematics.** This hermeneutic discipline of correct thinking is the only adequate perception of space-time that human consciousness has developed up to the present day.

As space-time is closed, any mathematical function with an infinite number of *unknown* variables ( $x^{n-m}$ ) can be reduced to a function with only one unknown variable  $y = ax$  ( $a = \text{cons.}$ ) when this function is applied to the real world. This function has a *definite* solution. The universal equation  $E = E_A f$  can be regarded as a function of the type  $f = ax$ , where  $a = E_A = \text{cons.}$  At the same time, it is always possible to define a real system of space-time as a system of reference and attribute the number “1” to it as a unit (24.) or the certain event  $P(A) = 1$ :  $f = ax = E = E_A f = SP(A) = 1$ . The epistemological explanation of this degree of mathematical freedom lies in the fact that all systems and levels of space-time are subsets of the primary term and contain themselves as an element (U-sets). This also explains the universal validity of the principle of circular argument (15.). As space-time is manifested in constant amounts of energy (12. & 14.), it is always possible to compare the space-time of one system or a concrete physical quantity thereof with the space-time of another system. One of the systems with the space-time of  $E_r$  is arbitrarily defined as a reference system and receives the number “1”:  $E_r = 1$ . The space-time of the other system  $E_x$ , or a quantity thereof  $x^{n-m}$ , is then assessed by the building of a relationship (quotient) with the reference system according to the principle of circular argument. Such relationships are constant magnitudes (*natural constants*):

$$(a^n x^n \dots + \dots a^{n-m} x^{n-m}) / y = E_x / E_r = E_x / 1 = E_A f \quad (25-4),$$

Where  $E_x = a^n x^n \dots + \dots a^{n-m} x^{n-m} = ax = E_A f = E_A = \text{cons.}$ , when  $f = 1$

As we see, the universal equation as expressed in (25-4) is valid for any physical quantity  $x^{n-m}$  which is always a subset of the primary term. This axiomatic knowledge effects another great simplification of our physical and mathematical outlook of nature.

Any comparison of one system with another can be regarded as an *energy interaction* (7.) and be an object of experimental research. Throughout this book we shall confirm on many occasions the following fundamental fact:

There is nothing else we can do in physics, but compare the space-time of a system, level, or an abstract quantity thereof, with that of another system or level.

As all systems and levels are open U-sets (7.), it is always possible to find an adequate energy interaction and measure the space and time of a concrete system, or assess a quantity thereof which contains the two constituents (19.). This is the only possible exercise in physical research. Any experimental result confirms the Universal Law in the particular experimental condition.

From an epistemological point of view, experimental research is a *tautology* of the Law.<sup>41</sup>

**26.** Each physical quantity as expressed in physics is a **relationship** between its actual magnitude and the magnitude of the unit(s) as defined by an arbitrarily chosen system of reference or a surrogate thereof (principle of circular argument, 15.). Each anthropocentric system of reference, like the SI system, can only be defined in a circular manner through the implementation of a **real** reference system. The universal real reference system used in physics nowadays is the **photon level** (24.). Since all levels and systems of space-time have only two quantities (constituents), space and time, and these can be expressed as pure, dimensionless numbers, all actual physical quantities can be presented as pure numbers within mathematics; the latter is, at once, their method of definition and measurement (building of quotients or relations of equal physical quantities). Their actual magnitudes are constant - such values are defined as **natural constants**. Natural constants can be determined in experiments<sup>42</sup>. Purely for this reason, it is possible to develop an *empirical model* of the universe based exclusively on numerical constants. In this way we eliminate all descriptive concepts in physics<sup>43</sup>.

The conventional units (dimensions) of physical quantities can be reduced to the two constituents - space and time. In this way it is possible to **eliminate** the SI system from the conventional presentation of physical laws and their applications and express them in the new [*space-time*]-symbolism (29.). In the new expression, all physical laws are axiomatically derived from the primary term - they are applications of the Universal Law for particular systems and levels of space-time.

**27.** The space and time of any system or level are numerical quantities (26.). If  $E_1$  and  $E_2$  are the energies of any two systems, we can obtain the following important derivation of the universal equation (18.), if we consider the equation  $E = E_A f = E_A v / [1d\text{-space}]$ , where  $E \approx f$  and  $E \approx 1/[1d\text{-space}]$ :

---

<sup>41</sup> This conclusion illustrates the absurdity of fundamental research. At the same time, it confirms the necessity of applied research with the objective of creating new space-time systems of practical relevance, e.g. vehicles driven by new energetic sources etc.

<sup>42</sup> Although the new axiomatics confirms all established mathematical and experimental results in physics and therefore does not need any further confirmation, it can be verified by experimental measurements of the numerous *new* constants which have been derived for the first time after the discovery of the Universal Law. However, it is questionable whether such redundant confirmation of the Universal Law will be of any material or intellectual benefit to society, except to convince some empiric fetishists in the field of science in the existence of one single law at the expense of taxpayers.

<sup>43</sup> See the input-output model of the universe in chapter 9.9.

$$E_1/E_2 = f_1/f_2 = [1d\text{-space}]_2 / [1d\text{-space}]_1 \quad (27-1)$$

Similar relationships can be obtained for any other physical quantity, since it will always consist of the two constituents, space and time (24., 25., 26. & 36.).

**28.** The *universal real system of reference* (19.) in the new axiomatics is the **space-time of the photon level**, which is assessed by the constant one-dimensional quantity of space-time, the *speed of light*  $c$  (24., 25. & 26.):

$$c = [1d\text{-space-time}]_p = \text{constant} \quad (28-1)$$

*Examples:* The speed of light is used as an intrinsic reference system in the relativistic expression of energy, mass, space and time in the theory of relativity (see discussion of Lorentz transformations in 43.).

**29.** Due to these considerations (24. to 28.), it is possible to **give up** the SI system and express all physical quantities as relationships with the space-time of the photon level, or any other arbitrary system of reference. Such relationships are **pure numbers**. This is the departing point for the development of a novel **input-output model** of the universe which consists of natural constants (26.).

**30.** The input-output model is equivalent to the *continuum* (the set of all numbers). Within mathematical formalism, the continuum can alternatively be presented as the **probability set** (see Kolmogoroff's axiomatics). Both presentations comply with the principle of last equivalence (2., 3. & 37.).

**31.** For theoretical reasons we can select the frequency  $f$  of *Planck's constant*  $h$ , called the **"basic photon"** in the new axiomatics, as a *reference* unit of absolute time  $f_p = 1$  (unit):  $E = hf_p = h$ . The time  $f_x$  of any particular system can be assessed in relation to this unit by applying equation (27-1):  $f_x = f_x/f_p = f_x/1 = f_x$ . Similarly, we can select the wavelength of the basic photon  $\lambda_A \cong 3.10^8 m$  as a unit of length  $\lambda_A \cong 3.10^8 m = 1$  and use the same procedure (27-1) to measure the space of any system. In this particular case, the SI unit of length "*metre*" will be obtained from the new unit " $1\lambda_A$ " by using the *conversion factor*  $A = 1\lambda_A/1m = 299,792,458.10^8$ .

*Examples:* The new unit of one-dimensional space  $1\lambda_A$  maybe somewhat clumsy for everyday use, but in physics it is an adequate substitute for the corresponding SI unit. For instance, the *Compton frequency*  $f_{c,e}$  of the electron can easily be calculated as a quotient of the wavelength of the basic photon and the *Compton wavelength* of the electron (27-1). The latter is a known physical constant ( $\lambda_{c,e} = 2,426.10^{-12} m$ ):

$$f_{c,e} = \lambda_A / \lambda_{c,e} = 1,236.10^{20} \quad (31-1)$$

In (31-1),  $f_{c,e}$  is an actual quantity of (absolute) time. As it is a quotient of two wavelengths, it is a pure number. In the conventional expression this constant is given in  $[s^{-1}]$ -unit, which is a mathematical inconsistency. Equation (31-1) can be applied to any other particle, such as proton and neutron (see Table 1). This example is not only a pledge for the mathematical advantage of the new approach over the standard method of measurement, but also an illustration of the arbitrary character of the SI system. It illuminates why it is possible to dispense with this artificial anthropocentric system and use instead **real** reference values for the two constituents, space and time, to which all quantities can be reduced. For practical purposes we shall still need a surrogate reference system; for theoretical reasons, we should eliminate the SI system in the presentation of physical laws. This is accomplished by the new *space-time* symbolism. This approach unveils the following fact:

The only thing we can do in physics is to compare the space, time, or space-time of one system with the space, time or space-time of another (25.).

From a theoretical point of view, there can be infinite permutations of the two constituents within mathematical and geometric formalism (16.). Such permutations are conventionally regarded as “distinct“ physical quantities. In reality, these terms sprout from the mind - hence the priority of consciousness in our axiomatics. This knowledge is a leitmotif of the present axiomatics.

**32.** The actual values of space and time of any system or level can be expressed in numbers which belong to the *probability set*  $0 \leq P(A) \leq 1$ . This is also true for any physical quantity which is an abstract permutation of the two constituents of the primary term. If the numbers are greater than the certain event  $P(A) = 1$ , their *reciprocal* value should be considered. Within mathematical formalism it does not make any difference whether we use a number (all numbers are quotients) or its reciprocal value, as long as we stick to this procedure in all further operations. From this, we conclude:

All actual space-time relations can be presented as *probabilities* of the set  $0 \leq P(A) \leq 1$ . Since all physical quantities can be reduced to space and time, this is also true for all physical quantities (29., 30. & 37.).

This conclusion is a recurrent motif in the present book. We shall present many proofs that confirm it.

**33.** The time of the *elementary action potential* (15.) of a level is a *constant* ( $f_{EA} = cons.$ ) because its energy  $E_A$  is also constant (14.). The same applies to

its space. This is also true for the time and space of any particular level or system, as it can be regarded as its own action potential (14.).

*Examples:* Each elementary particle can be regarded as its own action potential - in this particular case, it is the elementary action potential of the corresponding level (15.). The actual time  $f$  of such particles is constant as confirmed by their *Compton frequencies* (31.). The same applies to space - the *Compton wavelengths* of the particles are known physical constants.

**34.** As space-time is closed (4.), that is, we always observe a conservation of energy (see first law of thermodynamics), we can define the following fundamental axiom:

The action potential of a level or system  $E_{A1}$  is completely exchanged (transformed) in the action potential of another level or system and vice versa.

$$E_{A1} = E_{A2} \quad (34-1)$$

This is called „**the axiom of conservation of action potentials**“.

*Explanation:* This axiom encompasses any energy exchange  $E$  (8.). It is an iterative presentation of the universal equation (18.) and the primary axiom (1.) when applied to the parts:  $E_1 = E_{A1}f_1 = E_{A2}f_2 = E_{A2} = E_2$ , when  $f_1 = f_2 = 1$ . All known laws of energy conservation, such as the conservation of momentum, energy, mass, number of baryons, charge etc., are partial applications of the universal axiom of the conservation of action potentials. They are subsets (U-sets) of this axiom (34-1) because the quantities employed are U-subsets of the primary term.

**35.** The horizontal and vertical exchange of energy (11.) can be described in terms of **coefficients  $K$** . They are *quotients (relationships)* of the constant space-time of each pair of systems or levels under observation (27., 33. & 34.):

$$K_{1,2} = E_1 / E_2 \quad (35-1)$$

*Explanation:* The coefficients of energy exchange are also called “**absolute constants**“ because they are **dimensionless numbers** (relationships) that can be obtained in physical experiments. Due to their method of definition and measurement, they have no units. These new constants are powerful experimental evidence for the existence of the Universal Law. The absolute constants can be derived from known or new physical laws, which are always applications of the Universal Law for the particular level. The method of

derivation is called “**the construction rule of absolute constants**”<sup>44</sup> (see chapter 9.9). Such laws assess interactions between the levels. For instance, Coulomb law can be applied to any interaction between two static charges, e.g. two electrons. In this case, we apply this law to the electron level. The law of gravity can be used to assess an interaction between any two gravitational systems, which build a distinct gravitational level. As every level is an abstract set of equivalent systems (action potentials), the coefficients of energy exchange, which are assessed by these two laws, actually compare the space-time of the corresponding levels. Note: any relativistic system can be defined as an element of its corresponding level. For this reason we have an infinite number of levels of space-time (degree of freedom).

The coefficient of energy exchange in one direction is equivalent to the reciprocal value of the coefficient in the opposite direction (conservation of energy):

$$K_{1,2} = 1/K_{2,1} \quad (35-2)$$

This confirms a basic conclusion of the new physical axiomatics: one can use the actual magnitude of a physical quantity or its reciprocal value without infringing upon the principles of mathematics. As space-time is closed, there is no preferential direction for building physical relationships. This conclusion is of great cognitive and practical importance (see chapter 9.9).

**36.** The coefficients of vertical and horizontal energy exchange assess *time* and *space relationships* between the levels and systems. All possible and meaningful relations that can be built in physics are specific relations of time and space quantities (27., 33. & 35.):

$$E = \frac{E_1}{E_2} = \frac{f_1}{f_2} = \frac{[1d - space]_2}{[1d - space]_1} = \frac{SP(A)[nd - space]_1 f_1^n}{SP(A)[nd - space]_2 f_2^n} = SP(A) \quad (36-1)$$

**37.** According to the principle of last equivalence (2.), space-time can be defined as the **space of physical probabilities**<sup>45</sup>. In terms of statistics, it can

---

<sup>44</sup> We shall use this rule to obtain *Sommerfeld's constant* from two known applications of the Universal Law. This is one of the few absolute constants which are known in present-day physics, the origin of which cannot be explained from an epistemological point of view. By applying the new rule we shall derive many more absolute constants which empirically confirm the existence of the Universal Law (see chapter 9.9).

<sup>45</sup> We deliberately use the word “space” instead of “space-time”. We shall prove that statistics can only assess space-time as *static* space or time, but not as a *dynamic* recurring energy exchange (see *wave-particle dualism* and *superposition principle* in physics below).

be expressed with the *probability set*  $0 \leq P(A) \leq 1$ , as this set is an equivalent mathematical transformation of the continuum (see 30. and the essay below). The probability set includes numbers, which are objects of thought, while the physical probability space corresponds to the real world. In order to discriminate between both concepts, we use for the new term the symbol “**SP(A)**“. “S“ is an abbreviation for „**(s)tructural complexity**“. The meaning of this term will be explained in 46. Since all actual time and space quantities, and all physical quantities, which are composed of these two constituents, can be expressed in terms of pure numbers (32.), they belong to the space of physical probabilities. If the numbers are greater than “1“, we use their reciprocal values (35.). Thus we can use the symbol SP(A) for any actual quantity. In this context, we can regard the magnitude of any physical quantity SP(A) as an actual probability, that is, as the **structural probability SP** of the *event (A)*, written **SP(A)**, which belongs to the physical probability space  $0 \leq SP(A) \leq 1$ .

In our axiomatics all events in space-time are regarded as (a)ction potentials: (A) = *any event* (12.). Their space and time quantities can be expressed in terms of physical probabilities. Such quantities can be assessed during an interaction, e.g. during a statistical experiment, which is usually based on the comparison of space quantities (principle of circular argument). Since time is reciprocal space  $f = 1/t$  (23.), one can also use time quantities in statistics. Both types of quantities are expressed with **closed** real numbers that belong to the probability set  $0 \leq SP(A) \leq 1$ . So far, we do not have any mathematical method with which we can adequately assess space-time exchange. The reason for this is that energy exchange is an open recurring process which encompasses the whole universe - all systems and levels are open (7., see also the *principle of superposition* in electromagnetism).

*Explanation:* Any physical probability, with which the action potentials (events) occur in the physical probability space, can only be assessed as a relationship to a random space-time system of reference (principle of circular argument). This will be illustrated with the following example: Consider the clock simultaneously as a real physical system, which has to be described in terms of statistics, and a reference system of time. In this case, we can regard the events of the clock, such as one hour, one minute and one second, as distinct action potentials. Let the time reference unit<sup>46</sup> be 1 *second* according to the SI system. As the event “1 hour“ occurs once every 3 600 *seconds*, we can regard this event as a probability by building a quotient of the frequencies:  $A_{h,s} = f_h/f_s = 1/3600$ . This quotient is a pure number that belongs to the set  $0 \leq SP(A) \leq 1$ . We say in statistics: the probability of the event “1 hour“ to occur every second is 1/3600. As we have the degree of freedom to select any reference unit, we may choose the unit “1 hour“ as a reference of time. In that

---

<sup>46</sup> Note: when we regard conventional time as a numerical value in terms of statistics, e.g. 3600 seconds for one hour, we actually build a quotient  $3600s/1s = 3600$ . This is reciprocal conventional time and a direct quantity of absolute time:  $f = 1/t = 3600$ .

case, the probability of the event “1 hour“ to occur in the time reference period of “1 hour“ is exactly the “**certain event**“:  $SP(A) = f_h/f_h = 1h/1h = 1$ . We always obtain the certain event when we compare a system or a quantity thereof with itself. This simple knowledge of statistics is essential for an understanding of the relativistic term “mass at rest“ (see chapter 8.4). From this example, we draw the conclusion that the magnitude of any actual probability depends on an *a priori* choice of the reference system, which is an intrinsic part of any statistical test that we perform in the real world (method of measurement, 19.).

Alternatively, we can measure the circumference, which the clock hands sweep across during their circular motion, and describe the physical system “clock“ by presenting this one-dimensional space quantity as a probability. Let the clock hands for seconds, minutes and hours have the same length. In this case, they will sweep across equal circumferences, which are [1d-space]-quantities<sup>47</sup> (building of equivalence). In order to acquire actual probabilities, we must now build quotients with the various [1d-space]-quantities of the system “clock“ (building of relationships, principle of circular argument (15.)). If we compare the circumference  $S_s$ , which the clock hand for the seconds sweeps across during one second, multiplied by “5“, with the circumference  $S_h$ , which the clock hand for the hours sweeps across at the same reference period of time<sup>48</sup>, we acquire the reciprocal value of the complimentary probability of time  $A_{s,h} = S_s/S_h = 3600$ . If we now consider the reciprocal value of this space quotient, we obtain the above probability for the quantity time:  $1/A_{s,h} = A_{h,s} = 1/3600$ . This numerical value also belongs to the probability set  $0 \leq SP(A) \leq 1$  (36-1). As we see, we obtain the same statistical result if we consider *space* as the complementary energy constituent of the *time* reference system “clock“<sup>49</sup>. From this we conclude:

One can either depart from a *time quantity* or a *space quantity* to describe a *real* physical system in terms of **statistics**. This is also true for any physical quantity, as it can only be composed of space and time (equation (36-1)). This is the *epistemological*

---

<sup>47</sup> Alternatively, we may use the area which the clock hands sweep across. In this case, we can derive Kepler’s second law on the motion of planets from the physical system “clock“ (see mechanics below).

<sup>48</sup> The mechanical clock is constructed in such a way that the circumference of the event “1 second“ is 5 times shorter than the circumference of the event “1 hour“. This fact must be considered in the calculation (building of equivalence).

<sup>49</sup> The clock is not only a device of practical relevance, but also an adequate system of space-time, on which the fundamental assertion of the new axiomatics, namely, that space-time has only two constituents (dimensions) can be adequately demonstrated. We leave this exercise to the reader.

*background* of statistics as revealed for the **first time** in the new axiomatics.

This hidden physical background of statistics leads to fundamental cognitive blunders when statistical tests are conventionally applied to the real world. We shall illustrate this fact with another simple example. Instead of the SI unit, 1 *second*, we may choose to compare the circumference of the clock hand for the hours with the circumference of the clock hand for the minutes, by choosing the minute circumference as a reference unit of [*1d-space*]-measurement. In this case, we obtain a different probability value for the same event „1 hour“:  $A_{h,m} = 1/60$ . We conclude:

The value of any actual probability, which is determined from a *random sample* of the physical probability space, **depends** on the arbitrary *choice* of the physical reference system in each statistical test. The method of measurement (= method of definition) determines the magnitude of the actual probability. The winning of a random sample in the real world is an *energy interaction*.

This fundamental fact has evaded the attention of statisticians, who deal in the theory of probabilities exclusively with objects of thought and pay no attention to the physical content of applied statistical tests. As different statisticians usually choose different reference systems to test one and the same quantity, they inevitably obtain different probabilities. This is the origin of most confusion in applied statistics, which is ignorant on its epistemological background - the nature of space-time.

At present, it is generally believed that it is sufficient to postulate the *randomness* of a sample, in order to ascertain that it is representative of the total quantity, for which a statistical test is performed. However, randomness is a vague and abstract concept, which is always linked to an appropriate procedure performed by man. Any kind of randomisation is an operational negation of the *principle of causality*, which is the basic explanatory principle in medicine and bio-sciences. For instance, medicine as a science is essentially preoccupied to establish the causes of diseases and eliminate them - e.g. an organism causes an infection, hence its elimination with antibiotic therapy. *Randomness* (physics and statistics) and *causality* (medicine, bio- and social sciences) are paradoxical concepts that are simultaneously applied to explain nature. Notwithstanding this fact, randomness is regarded a sufficient condition that guarantees the objectivity and validity (reproducibility) of statistical tests, e.g. in clinical research (see volume III). In reality, every statistical method that includes randomisation depends on the *subjective* choice of the *reference system*, which is at once of mathematical and non-mathematical character. It always involves space-time as an element. The reference system is an intrinsic part of any statistical experiment. As statistics deals with numbers,

which are objects of thought, statisticians pay no attention to the physical background of the reference system, while they are developing new statistical methods. Thus they have overlooked the theoretical implications which arise as soon as statistical results are interpreted in real terms. This is the actual “terra incognita“ of statistics and the theory of probabilities. As most statistical tests implement different systems of reference, they usually produce different results for the same quantity under investigation - such results are not comparable. This has aroused a wide-spread distrust in the validity of statistical results in clinical and other research.<sup>50</sup>

The new axiomatics explains the epistemological background of the probability set. It confirms that all probabilities are space, time, or space-time relationships (36.). The building of relationship is an energy interaction. As all systems and levels of space-time are open - they exchange space-time - all probabilities, being quantitative relationships of space-time, are interrelated. They are **dependent** variables. The classical concept of probability says that the actual probability values of a quantity under investigation should be independent (Laplace) - hence the necessity of randomisation. The general belief is that independent events should have the same probability. One searches in vain for an explanation why only independent events should have the same probability or, vice versa, why equivalent probabilities should be an evidence for the independence of events. The answer to this fundamental theoretical question in statistics lies in the nature of space-time - its constancy as manifested by the parts.

In reality, all physical events, being action potentials, are *interdependent* - space-time is an interrelated unity of energetic events (action potentials). This fundamental characteristics of space-time is summarized in the *axiom of the conservation of action potentials* (34.), which is confirmed by all known laws of energy conservation. On the other hand, the action potentials of levels and

---

<sup>50</sup> Especially in clinical research (Phase II and III trials) this leads to a profound confusion as soon as investigators begin to interpret their results in terms of medical relevance and therapeutic recommendations. Most of the primary endpoints used in clinical trials are *surrogate* endpoints which are not validated (unproven validity of the reference system). This fact leads to a completely erroneous evaluation of the efficacy and safety of major drug groups and unjustifiably permits their registration. For instance, the German drug registration authority estimates that 18 000 drugs now available on the German pharmaceutical market have not been tested for efficacy and safety to appropriate standards (SZ, 2/3 October 1997, p. 30). This official estimate is representative of any other industrial country. In volume III, I prove that about 80-90% of the approximately 5000 chemical entities, which are now available on the world pharmaceutical market, *infringe* upon the Universal Law when it is applied to biological regulation of cells and organisms (see the novel *dipole model* of pharmacology). Such drugs actually increase the long-term morbidity and mortality of patients when compared to placebo (see chapters 2.8 & 2.9 in vol. III).

systems are *constant* (14.), therefore their actual space and time quantities can be experimentally measured as natural constants (35.) and expressed in terms of equal probabilities (equal quotients). Hence the classical belief in statistics that independent events of the same type must have the same probability. Here we encounter an intuitive perception of the primary term as an *inhomogeneous* entity of constant energy events. As this idea cannot be explained in physical terms - Kolmogoroff's axiomatics makes no efforts, whatsoever, to furnish an existence proof for statistics in the real world -, it is introduced in the theory of statistics as a *cogent statement* without any further elaboration (see also Laplace's classical definition of independent probabilities). This intuitive assumption is then imbedded into the secondary axioms of Kolmogoroff's theory of probabilities. Since Hilbert this is considered to be the only criterion of truth in metamathematics<sup>51</sup>. Now, for the first time in the history of mathematics, the „proof of existence“ can be presented in the real physical world.

### **Essay: Probability set and continuum are mathematical concepts of space-time**

In this essay we shall discuss the semantic equivalence between the two basic concepts in mathematics - the *continuum* in the theory of sets and the *probability set* in the theory of probabilities, also known as statistics. Both terms are formalistic mathematical concepts of space-time (energy) - they are equivalent to the primary term (1. & 2.).

The continuum of real numbers is specified by its *limits: zero and infinity*: Their mathematical symbols, “0“ and “∞“, have no further meaning and can be substituted by any other symbol. Both terms are abstract concepts (objects of thought) - they cannot be defined in a finite way within the system of mathematics. Their epistemological background can only be explained in the real world (18.). According to the primary axiom, we can assign the primary term, which is the only real thing, the symbol of infinity:  $E = \infty$  (1., 2., 8.). We shall show that the same is true for the symbol “0“. The definition of both limits is intrinsically linked to the primary number “1“. This number is of universal character. It can be attributed to the primary term (18., 21. & 25.). As a closed number, the “one“ symbolizes the closed character of space-time (18-4). At the same time, it is a mathematical symbol of reciprocity. Here, we must recall that the only *real* reciprocity is that between space and time (23.). Mathematical reciprocity, which is basic to all operations, is a metaphysical

---

<sup>51</sup> Hilbert expresses his belief in a letter to Frege: „Wenn sich die willkürlich gesetzten Axiome nicht einander widersprechen mit sämtlichen Folgen, so sind sie wahr, so existieren die durch die Axiome definierten Dinge. Das ist für mich das *Criterion der Wahrheit* und *der Existenz*.“ In H. Meschkowski, Einführung in die moderne Mathematik, BI, Mannheim, 1971.

reflection of this immanent property of the primary term. All further reciprocities are conceptual derivations of this primordial reciprocity.

Within mathematics, there are many secondary definitions of the limit which can be obtained in a circular manner. The most straightforward is the following: The limit of  $1/n$  (building of reciprocity) is “zero“ as  $n$ , being the set of all real numbers, approaches “infinity“: The formal expression is:  $1/n \rightarrow 0$ , when  $n \rightarrow \infty$ . From this definition, it is cogent that such symbolic presentations cannot explain the two concepts, zero and infinity, in real terms. They are limits not only in the actual meaning of the word, but also in terms of epistemology - there is no mathematical knowledge beyond zero and infinity. Zero and infinity are *hermeneutic* boundaries of mathematics. This is the departing point of the new axiomatics. In terms of mathematics, zero is a limit of reciprocal infinity  $0 \rightarrow 1/\infty$ . According to the primary axiom, this symbol can also be applied to the primary term:  $E = 1/\infty = 0 \rightarrow 1/\infty$  (1., 2., 8. & 23.). Evidently, both terms, zero and infinity, have the same origin - they are *pleonasms* of the primary term. This will be substantiated below.

In the new axiomatics, we define space-time (energy) as *infinite*  $E = \infty$  because it is without a beginning and an end - it is closed and in a state of incessant energy exchange. The primary axiom is a *commutative law* - infinity is space-time:  $\infty = E$ . Regardless of the symbols used, these are *empirical descriptions* of the primary term which cannot be defined any further. In mathematics, they are introduced formalistically and without any explanation. In the new axiomatics, they are put at the beginning as primary axioms. Although they are mental concepts, they reflect reality. This is the fundamental difference to the primary mathematical concepts, “zero“ and „infinity“ - the latter are pure objects of thought and have no real meaning. The truth (validity) of the primary axiom of the new axiomatics (1.) can be experimentally confirmed by all secondary statements and theorems. The latter can be physical laws and their applications, which are *axiomatically derived* from the Universal Law. The conservation of energy is such a law. It confirms the closed character of space-time and the open character of its subsets - the energy exchange between the systems and levels.

Under the term “axiomatic derivation“ we understand any procedure that complies with the principles of mathematical formalism. These are: **self-consistency** and **lack of inner contradictions**. The two principles are the core of **deductive logic**, which is instrumental to mathematics. The operative principle of deductive logic is the *principle of circular argument* (15.) - all numbers and their corresponding axiomatic terms are relationships (Bourbaki). When this principle is applied to the whole, i.e., to the primary term, it is called the *principle of last equivalence* (2.). We shall show that the definition of the continuum in the theory of sets is based on this principle. If all secondary terms, which belong to a categorical or mathematical system, are derived axiomatically (logically) from the primary term (U-sets), this principle is **not** vicious and leads to an ultimate knowledge of the Universal Law. Such

systems are adequate assessments of the Law in the phenomenology of natural events. The new axiomatics presented in this volume is such a system. It encompasses mathematics and any particular scientific system - hence its intrinsic propensity to unify science. The Universal Law is a mathematical expression (equation) of the primary term (1.). It can be used to describe any actual phenomenon of space-time. Any phenomenon (event) of space-time can be regarded as an action potential. This explains the validity of the universal equation  $E = E_A f$  for any particular physical event:  $E = E_A$ , when  $f=1$  (1. & 2.). The empirical corroboration of this axiomatic result in physics is a major objective of this volume.

The above explanation is circular and this is a fundamental proof that space-time is a *closed energy exchange* and therefore *infinite*. **The primary term is the limit of all human knowledge**, just as “zero“ and “infinity“ are considered to be the mathematical limits of the continuum. Any intellectual effort, no matter how ambitious, ends up with the primary term.<sup>52</sup>

This survey proves that the continuum, being a mirror image of space-time, can only be defined by its *infinity* “ $\infty$ “ and its reciprocal value, the *infinite small number* or *zero*  $1/\infty \rightarrow 0$ , which are equivalent symbols of the primary term (equations (8-2), (18-4) & (18-5)). This follows from the principle of last equivalence (2.). The theory of sets is unable to present any other finite definition of the continuum, which is considered to be the “paradise“ of mathematics (Hilbert). This becomes evident when we take the following semantic equivalence. We can express the continuum as an infinity and describe it in terms of continuousness. By applying the principle of last equivalence as a commutative law, we acquire the equation: *infinite continuum = continuous infinity*. This circular tautology does not enlarge our knowledge. All mathematical definitions of infinity in the theory of sets or continuousness in

---

<sup>52</sup> This is an extremely important conclusion for anyone who questions the ultimate tautology of the primary term as the limit of knowledge and its universal operational application - the principle of circular argument. This highly unreflective criticism from the traditional point of view, which one encounters whenever the new axiomatics is being presented for the first time, is merely a symptom of the rudimentary education of present-day scientists in logical and axiomatic thinking. The temporarily limited acquisition of quantitative knowledge in our modern educational systems completely neglects the teaching of logic. This discipline of correct thinking was central to education in antiquity when it was generally accepted that logic should be trained during the whole life. Most of the pupils of Socrates are, for instance, in advanced age, but they do attend with pleasure his lectures (dialogues) on applied logic. It is impossible to imagine such philosophical circles nowadays. However, to think logically, is the only way to live according to the Law.

geometry<sup>53</sup> are of the same circular character, no matter how sophisticated they might appear.

The same applies to the **probability set**, which is the primary term in Kolmogoroff's axiomatics of the theory of probabilities. The conceptual ontology of this discipline is very similar to that of geometry - it is also based on a few *a priori* concepts that cannot be explained any further. Both disciplines are the preferred set of mathematical instruments for describing nature. Geometry is the method of measurement in Newton's classical mechanics, wave theory and electromagnetism. In these disciplines, Euclidean space is the initial conceptual frame, within which all other terms are defined. While the theory of relativity, which is based on Minkowski world, is still attached to geometry, modern physics as embodied in quantum mechanics, quantum electrodynamics (QED) and quantum chromodynamics (QCD) has resorted to the statistical method. This trend begins with *Boltzmann* in thermodynamics and is continued by *Schrödinger* in his *wave equation* of quantum mechanics, which incorporates both the geometric and the statistical method. The statistical approach is predominant in QED, since *Feynman* has introduced the method "sum over the histories". QCD of *Murray Gell-Mann* is from a methodological point of view a copy of QED. While the statistical method is gaining momentum, thereby leading to "a complete loss of common sense" in physicists' efforts to comprehend what is happening at the microscopic level (*Feynman*), the geometric method is not abandoned entirely. It is still the solid frame of "common sense". This opens new possibilities for mixed mathematical approaches - for instance, the introduction of tensor spaces, multi-dimensional spaces etc. Unfortunately, all new developments of mathematical instruments in physics are being accomplished at the expense of cognitive knowledge, and this leads to the present intellectual confusion in this science.

The reason why the statistical and geometric approach are adequate reflections of the physical world lies in the fact that they are equivalent axiomatic systems within mathematical formalism and have a common origin in the intuitive perception of space-time. Their basic terms and axioms intuitively reflect the properties of the primary term in the new axiomatics. As any geometric definition can also be expressed in terms of algebra, as proven by *Bertini* and *Klein*, while the latter is a particular discipline of mathematics that is based on the theory of sets, it is sufficient to show that the continuum and the probability set are equivalent concepts<sup>54</sup> to prove that mathematics and statis-

---

<sup>53</sup> Without the continuousness of points it is impossible to build a straight line, a plane, or any geometric figure. Without the concept of space continuity geometry is a nonsense. This has already been stressed by *Lobachevsky*. The concept of continuousness is intrinsic to all spatial ideas and excludes the existence of vacuum - the void is an interruption of continuity.

<sup>54</sup> The part of mathematics that deals with these concepts is also called "meta-mathematics".

tics are equivalent systems for the assessment of space-time. In this way we shall ultimately prove that mathematics is the only adequate scientific perception of space-time. This inevitably leads to the conclusion that **physics is mathematics applied** to inorganic matter, just as economics (micro- and macro-) is mathematics applied to the economic level of human activity (44.), while clinical research (scientific medicine) is mathematics (statistics) applied to the human organism (organic matter).

Every intellectual effort to grasp the external world begins as a descriptive system and evolves within a certain period of time to an exact mathematical discipline. On the other hand, each mathematical system, when formalized by finite procedures, inevitably leads to a collection of primary concepts, which are products of the mind and cannot be described in a finite way in the formal language of mathematics (Gödel). This meta-analysis of the dynamic structure of science reveals the closed, mathematical character of space-time, which is the primary term of all scientific disciplines. This can be illustrated by the following two historical examples:

a) *Physics* at the time of *Galilei* was more or less a matter of description and became a mathematical science, only after *Newton* and *Leibniz* developed *differential calculus*, with which they were in a position to calculate *velocity* (Recall: velocity is a physical quantity which assesses motion as the universal manifestation of energy exchange (20. & 21.)). Any further development of physics since Newton has been intrinsically linked to the development of mathematics. For instance, modern quantum mechanics could only be developed once Riemann had established the foundations of modern geometry.

b) *Economics* at the time of *Adam Smith* and *David Ricardo*, generally acknowledged to be the founders of this discipline, was still a descriptive social-ethical science with a moral overtone, although algebraic applications in finance, first stimulated by the Arabs, had been widely used in Italy since early Renaissance, and the French Physiocrat *Quesnay* had already invented the “Tableau“. This mathematical invention is a forerunner of *Leontieff* input-output models. The latter permitted the calculation of GNP in terms of mathematics for the first time more than 50 years ago and developed economics to a modern explorative and experimental science. *Keynesianism*, *monetarism*, various micro- and macromodels, stochastics (Markov’s chains), game theory and last, but not least, the statistical method are nowadays the only generally accepted mathematical approaches for describing and modulating the economic level, which is an U-set of space-time<sup>55</sup>.

While these empirical disciplines search for their “paradise“ in applied mathematics, this discipline has been in a foundation crisis ever since Gödel’s first theorem appeared in 1931, as embodied in the *continuum hypothesis*, which still awaits a final solution. This is the central paradox (antinomy) of science at the end of the Second Millennium when its basic concepts are analysed from an

---

<sup>55</sup> The new theory of economics based on the Universal Law is presented in a separate book.

epistemological point of view. By proving that continuum and probability set are equivalent concepts of space-time, we shall solve the continuum hypothesis in the *real* world. For this purpose we have already shown that the continuum is an *a priori* concept in the theory of sets and can only be defined by tautological terms, such as “zero“ and “infinity“. This is already a fundamental proof that the mathematical continuum is a synonym of the primary term (1.). We shall now show that the same is also true for the probability set, which is basic to the theory of probabilities and applied statistics. We begin with the primary axioms of **Kolmogoroff’s axiomatics**. These are:

A function  $P$  that is defined within a **system of events** is called **probability**, if it fulfills the following axioms:

*Axiom I:* The probability  $P$  of an event is a definitely determined non-negative real number which belongs to the probability set  $0 \leq P(A) \leq 1$ ;

*Axiom II:* The **certain event** has the probability “1“ ( $P = 1$ ).

Any other axiom or statement within the theory of probabilities can be derived from these two axioms. As the objective of this essay is to explain the primary terms and axioms of mathematics, we shall concentrate on these two axioms and scrutinize them in terms of an *a priori* knowledge. Both axioms contain a number of descriptive concepts, which have their origin in the mind and cannot be explained within the theory of probabilities or mathematics. These are: *system of events*, *probability*, *probability set* and *certain event*. Let us begin with the term “event“. Kolmogoroff’s axiomatics is simply not in a position to specify what one should understand under the term “event“ - this term is introduced *ad hoc* without any further mathematical explanation. Within the theory of probabilities it is up to the individual statistician to decide what an “event“ really means. This opens up an abyss of arbitrary decisions, which have nothing to do with mathematics, but are of a highly subjective and speculative nature.

Contrary to Kolmogoroff’s approach, the new axiomatics gives a clear-cut definition of a physical event. Any particular event in space-time is regarded as an *action potential* with a constant amount of space-time that is specific for this event (12., 13. & 14.). Space-time is discrete (5.) and presents itself in form of energy quants. This is the universal experimental evidence. As statistics is mathematics applied to the real world, one should understand under the primary statistical concept “system of events“ the primary term as space-time (energy) (1.& 2.). The energy of any particular action potential that occurs in space-time can only be described in terms of constant relations (quotients) of space, time, or any other quantity, e.g.  $E_A = E/f = \text{cons.}$  (22. & 24.). Such numerical values can be expressed as probabilities - any *probability* is a mathematical expression of an actual space-time relationship (35. 36. & 37.).

For this reason, we also speak of the primary term as “the space of physical probabilities“. Thus the “probability set“ in Kolmogoroff’s axiomatics is a formalistic, abstract idea of the primary term “space-time (energy)“ in the new axiomatics. However, the primary term, although a mental concept, is not a pure object of thought, as is the case with the probability set or any other mathematical term, which are products of an abstract definition. The primary term is equivalent to real existence and can be confirmed *experimentally* through the phenomenology of being.

Continuum and probability set are therefore equivalent terms which are built in a hermeneutic manner within the framework of mathematical formalism. This can be easily demonstrated. The probability set is obtained from the continuum by using the primary number “1“ which is equivalent to the primary term in the new axiomatics (2., (8-2) & (18-5)). This number is attributed in an *a priori* manner to the “certain event“ in Kolmogoroff’s axiomatics (axiom II). Therefore the term “certain event“ is a synonym for space-time according to the principle of last equivalence. As the primary term is infinite, we can also give it the symbol for infinity “ $\infty$ “ (4., 8. & 18.). The primary epistemological equivalence between the two mathematical symbols, “one“ and “infinity“,  $1 = \infty$  (1.), is the origin of all operations in mathematics, including the transformation of the continuum into a probability set. We shall prove this in a formal way.

When we build a quotient (relationship) between the two semantic equivalent symbols for the primary term, “1“ for closed space-time and “ $\infty$ “ for infinity, we obtain an infinite small number  $1/\infty$  that approaches “0“ (see definition of limits above). “Zero“ is thus a secondary term - it is an abstract U-subset of the primary term. The two symbolic presentations: 1)  $1/n \rightarrow 0$ , when  $n \rightarrow \infty$ , that is,  $1/\infty$  and 2)  $0 \leq P(A)$  are equivalent - they are symbolic *pleonasm*s within mathematical formalism. Thus “0“ is an abstraction (idealisation) of the infinite small number “ $1/\infty$ “. If we build a quotient of the two equivalent semantic symbols for infinity “ $\infty$ “ and “1“ we obtain the infinite great number:  $\infty/1 = \infty$ . The infinite great number “ $\infty$ “ is a reciprocal of the infinite small number  $1/\infty$ . Thus the infinite small number or zero and the infinite great number or infinity are dialectically linked. They are abstract symbols of the two constituents, space and time - like these, they are canonically conjugated, reciprocal magnitudes. In mathematics, they are defined as the limits of the continuum, while the continuum (space-time) is the limit of any knowledge. The multiplication<sup>56</sup> (conservation of energy) of the two symbols

---

<sup>56</sup> Multiplication can also be expressed as integration:  $\sum 1/\infty \times \sum \infty = 1/\infty \times \infty = 1$ . We say, the integral or aggregated product of all infinite small levels and all infinite great levels of space-time assesses the universe (space-time); or, alternatively: the microcosm constitutes the macrocosm and vice versa. The smallest extent, e.g. in quarks, contains the greatest energy and vice versa. Such statements are variations on the

gives the primary number:  $1/\infty \times \infty = 1$ . This number is a symbol for space-time and the certain event.  $P(A) \leq 1$  is an equivalent symbol (expression) of this result - the certain event is the limit of being. This is a circular proof of equivalence between the two concepts - the probability set and the continuum (1. 2. & 3.).

As we see, the probability set is also limited by the infinite small number and the infinite great number, which are canonically conjugated magnitudes. In statistics, the infinite great number,  $\infty/1 = \infty$ , is expressed with the equivalent symbol "1" (1., 2. & 8.) and defined in a secondary step as the "certain event". Thus the limits of the probability set, 0 for  $1/\infty$  and 1 for  $\infty$ , assess at the same time the reciprocal behaviour of space-time (proof of existence). Hence the equivalence between the probability set  $0 \leq P(A) \leq 1$  and the continuum  $n$  - they are pleonastic mathematical concepts of the primary term. The operations (transformations) above are based on the principle of last equivalence and are mathematical tautologies of the primary term. The various symbolic expressions of the primary term, such as  $1 = \infty = 1/\infty = \infty/1 \geq 0$  are primary, true statements that reveal the closed and infinite character of the constant space-time. This term is at once the limit and origin of any true knowledge - be it mathematical, physical, metaphysical, religious<sup>57</sup> or literal.

The intellectual problems which mankind has encountered in its comparatively short history of scientific evolution are not due to the hypothetical complexity of nature, as is explicitly stated in modern empiricism, but originate from the inability of scientists to create a universal, axiomatic language based on the primary term. This was the dream of Leibniz, Boole, Russell, Whitehead and other mathematically orientated philosophers or philosophically orientated mathematicians (see footnote 21.) - and, I think, it is not imprudent to say: "The new axiomatics is the realization of this dream."

From this survey on the origin of mathematics, we can conclude that its basic concepts and axioms can adequately be expressed with only three fundamental symbols, which stand for the various equivalent aspects (properties) of the primary term (1., 2., 8. & 18.). These are:

- |  |                                 |
|--|---------------------------------|
| 1. The infinite small number or zero   | - $1/\infty \rightarrow 0$      |
| 2. The infinite great number or infinity   | - $\infty/1 \rightarrow \infty$ |
| 3. The primary number "1" for space-time, energy, continuum, the whole, the certain event etc. | - 1                             |

---

same theme - they assess the reciprocity of space and time which is an aspect of the constant character of space-time.

<sup>57</sup> It could be shown that all religions are intuitive, partial perceptions of the primary term and the principle of last equivalence. This aspect is discussed in volume I and is a central theme in volume IV on philosophy.

With these three symbols and the two additional symbols for relationships, (=) and (<), or their combination ( $\leq$ ), one can express the continuum *ecclesiastically* as the set of all numbers:  $0; 1/\infty \leq n \leq \infty, 1$ , or the probability set:  $1/\infty, 0 \leq SP(A) \leq 1, \infty$ . Note: The symbol for “approaches as a limit“ ( $\rightarrow$ ), e.g.  $1/\infty \rightarrow 0$ , is a pleonasm of the symbol  $0 \leq 1/\infty$ . From an epistemological point of view, they are equivalent formalistic perceptions of space-time as a dynamic entity which can approach both infinite small and infinite great values. It is important to stress that the symbol for relationship and reciprocity ( $/$ ), e.g.  $1/n$ , is, in fact, a symbol for division ( $:$ )  $1 : n$ . This symbol is already included in the equivalence of the primary term “space-time = energy“ (1.):

$$\begin{aligned} \text{space-time} = \text{energy} &= \text{space-time/energy} = \text{space-time} : \text{energy} = \\ &= \infty/\infty = \infty = 1 = \text{the certain event} \end{aligned} \quad (37-1)$$

All further symbols and signs of relations in mathematics are axiomatically derived from this primordial “trinity“<sup>58</sup> of mathematical symbols, which we attribute to the primary term: “1“ for space-time, “ $\infty$ “ for infinity, and “=“ for the equivalence between the terms, e.g. between space-time and infinity:  $1 = \infty$ . The symbol “ $\leq$ “ indicates that consciousness, being metaphysical space-time, has the potential to be equivalent to the primary term (equipotence of consciousness, 3.), but that this equivalence may not be achieved at the level of individual human consciousness - a fact that has been empirically verified in numerous discussions with physicists on this issue<sup>59</sup>. However, we should also be aware of the fact that these symbols are arbitrarily chosen and can be substituted by any other symbol (degree of mathematical freedom).

The mind is evidently not in a position to assess space-time in an appropriate manner, unless it uses more than one term or symbol. Indeed, consciousness needs more than one word to describe the “whole“ - the present

---

<sup>58</sup> The trinity concept in Christianity is an intuitive perception of the primary term. It acknowledges the fact that the primary term is the limit of any gnostic knowledge (tautology due to the closed character of space-time), but that human consciousness can only describe the transcendence of being by using additional words. Such terms can be equivalent to the primary term, as is the case with the trinity of Father, Son and Holy Ghost, or they can be subsets thereof (U-sets). For instance, some early Christians believed that Jesus Christ was not equivalent to Father and Holy Ghost. This caused an early schism of the Church. As we see, even religion depends on the proper axiomatic definition of its primary terms. In fact, all trivial, religious and scientific terms which build the tissue of language are conscious or unconscious subsets of the primary term. This has not been realized so far - hence the infinite misunderstandings between human beings during their linguistic communication.

<sup>59</sup> The restriction of human consciousness at the present level of evolution is energetically determined. This aspect is covered in a separate book on human gnosis.

volume confirms it - and an infinite number of words to describe the parts (systems and levels of space-time). This linguistic “atomization“ of scientific and trivial ideas is part of human evolution, but it is also a trap for human intelligence. It allows human beings to assess the phenomenology of space-time, to interact with the infinite levels and systems of space-time, and to create new systems of growing complexity, e.g. society, economy etc. Consciousness (in German “Bewusstsein“, which means “to be aware of being“) is an evolutionary process of new ideas that make us aware of being. For instance, in physics we can only describe the nature of space-time, if we discriminate between space and time:

$$\begin{aligned} [\text{space-time}] &= [\text{space}] \times [\text{absolute time}] = [\text{space}] f = \\ &= \text{velocity} = v = v^n = 1 \end{aligned} \quad (37-2)$$

To this ability to discriminate we owe the invention of mathematics. From (37-2), we axiomatically obtain the *reciprocal* character of the two constituents (23.):

$$f = 1/[\text{space}] \text{ or } [\text{space}] = 1/f \quad (37-3)$$

This reciprocity is an intrinsic property of the continuum ( $1/\infty$  or  $0$  and  $\infty$  or  $\infty/1$ ) and the probabilistic set ( $0$  or  $1/\infty$  and  $1$  or  $\infty/1$ ). Purely for this reason, the new axiomatics is based on **three** fundamental symbols (38.), although it is possible to express space-time and its parts with only **one** symbol -  $n$  for the continuum or  $SP(A)$  for the probability set. As all actual quantities of space and time can be expressed in numbers (relationships) that belong to the continuum  $0, 1/\infty \leq n \leq \infty, 1$  or can alternatively be presented as probabilities of the set  $0 \leq SP(A) \leq 1$ , we could use only **one** symbol for all physical quantities - either  $SP(A)$  or  $n$ . In the new axiomatics, we have decided to use the symbol **SP(A)** because the statistical method is predominant in modern physics. There is no other reason for this decision. For cognitive and practical reasons, we shall further distinguish between space [ $nd$ -space] and (absolute) time  $f$ . In the new presentation of conventional physical quantities and their relationships, which are traditionally defined as “physical laws“, these symbols may appear as distinct quantities which can be united anytime to form [ $space$ -time] and vice versa (the primary axiom as a *commutative law*):

$$\begin{aligned} [\text{space}] \times [\text{time}] &= [\text{space-time}] = SP(A)[nd\text{-space-time}] = \\ &= SP(A)[nd\text{-space}] f^n \end{aligned} \quad (37-4)$$

The symbol [ $nd$ -space] encompasses all geometric presentations, while the symbol  $f^n = [\text{time}]$  - all mathematical expressions, i.e., all numbers:  $f^n = f =$

$n = \text{continuum} = SP(A)$  (38-2). This discrimination is historically pre-determined and is not a prerequisite of space-time - space-time is a unity. As all physical quantities can be expressed with these symbols, they are abstract subsets built within mathematical formalism (method of definition). They **do not exist** as *distinct* physical entities. With respect to didactic clarity and simplicity, the symbol  $SP(A)$  is applied mainly to the two basic physical terms, *charge*  $Q$  and *mass*  $m$ . Both quantities are abstract U-subsets of the primary term (41. & 46.).

All U-subsets of the primary term contain the whole as an element - hence the ubiquitous character of the Universal Law. The principle of last equivalence is a comparison of the primary term with itself due to its closed character. In this context, the statistical concept of the "certain event" is a mathematical pleonasm of the primary axiom (1. & 2.). Since the subsets contain the primary term as an element, we can also apply the same principle to its parts, i.e., to the levels and systems of space-time (principle of circular argument). Whenever we compare a system or a level with itself, we can formally assign this subset of space-time the primary number "1". As any system or level can be regarded as its own action potential, the number "1" can be attributed to any action potential that has occurred in space-time (degree of freedom). For this reason, we can use the symbol of the certain event  $SP(A) = 1$  not only for space-time, but also for any particular event (action potential) of space-time. The use of "1" for any voluntarily selected unit of a physical quantity is an identical mathematical procedure. We conclude:

The **certain event** symbolizes the realization of the *structure* ( $S$ ) of an *action potential* ( $A$ ) of space-time when this *physical event* is compared with itself  $A/A = 1$ . The probability  $P$  of this action potential is written  $SP(A) = 1$ . As space-time can be voluntarily regarded as its own action potential  $E = E_A$ , the certain event can also be applied to the primary term  $SP(A) = E / E_A = 1$  (1. & 2.). In this case, *time* can also be presented as the certain event  $f = 1$ . As  $[space] = 1/f = 1/1 = 1$ , *space* can also be the certain event. This is true for any quantity of space-time. The definition of physical units is a mathematical tautology of the definition of the „certain event“.

This is the degree of freedom of human mathematical consciousness<sup>60</sup>. When the principle of last equivalence (2.) is applied to the parts, we call it the prin-

---

<sup>60</sup> The iteration of identical operations and their subsequent chaining has produced the system of modern mathematics as a mirror image of space-time. When similar recurrent procedures are iterated in computers, they can produce *fractal* structures of spatial character (see, for instance, Peitgen, Jürgens & Saupe, *Chaos and Fractals*, New Frontiers of Science, Springer, New York, 1992.).

principle of circular argument (15.). The conventional application of the principle of circular argument is the origin of all cognitive mistakes and paradoxes which we encounter in physics. When this principle is derived in an axiomatic manner from the primary axiom (from the principle of last equivalence), it leads to true knowledge. When it is only applied to the parts, while at the same time the epistemological background of the primary term is completely neglected, as is the case in physics nowadays, it is a *vicious* circle. In this sense, all present definitions in physics, such as the definition of charge, mass, or relativistic mass, electric current and energy<sup>61</sup> are vicious. The consequence is that physics cannot explain the nature of these quantities<sup>62</sup>.

The use of the closed number “1” as the certain event or a SI unit in physics has led to the famous “**wave-particle dualism**“, which is in fact an “energy-matter-dualism“. The underlying idea behind this purely *semantic* discrimination, which is erroneously considered by most physicists to be a real property of nature, is rather trivial. It is generally assumed that matter (substance) has a *structure*, while energy has no structure. While the *structural complexity* (= *complexity of space structures*) of matter can be measured through geometry, energy cannot be assessed in geometric terms - hence the idea of the dualistic nature of the world. Under “energy“, physicists usually understand the energy of the photon level. For instance, Einstein’s equation  $E = mc^2$  expresses this view (43.). Structure is intrinsically a spatial concept that is attributed to matter, while energy is considered to be a structure-less entity which can only be expressed in pure numbers<sup>63</sup>. For instance, the first thermodynamic law presents the conservation of energy as a numerical equivalence between the various forms of energy, e.g. electric, mechanical, thermal, chemical etc., which this law describes in a static way (balance of

---

<sup>61</sup> In order to comprehend the vicious character of the present definition of energy, we draw the attention of the reader to the simple fact that the SI unit for energy, 1 *joule*, is not considered a basic unit, but a derivative of the three other basic units, 1 *kilogram*, 1 *metre* and 1 *second*: 1 *joule* =  $1\text{kgm}^2\text{s}^{-2}$  ( $E = mc^2$ ). However, the units, 1s and 1m, belong to the two constituents of energy (space-time), which are abstract U-subsets of the whole. We shall prove below that the quantity “mass“ is also an abstract quantity of the primary term - it is defined as an energy relationship (41.). As we see, traditional physics does not regard the primary term of energy as fundamental. Although all physical laws describe energetic interactions, energy (space-time) is defined in a *secondary* manner through its subsets, such as mass, distance and conventional time, which are erroneously regarded as “distinct“, fundamental physical quantities. Hence the cognitive blindness of modern physics - its inability to perceive the Universal Law behind the physical phenomenology which it describes.

<sup>62</sup> See PA Tipler, p. 618, German edition.

<sup>63</sup> See discussion on energy conservation in „The Feynman Lectures on Physics“, vol.1, chap. 4 and equation (46-3).

energy). However, it does not make any statements on the conservation of structures. This is beyond the scope of this or any other physical law. We shall show below that the dualistic discrimination of nature in structural matter, for instance, particles, and structure-less energy, for instance, electromagnetic waves, is an abstract semantic process of consciousness which takes place *within mathematical formalism*; its ontology is the use of the primary number “1” as specified above.

The use of the primary number “1” for subsets of the primary term can be a trap from a cognitive point of view, as the basic concepts of physics reveal. Since this number is also attributed to the primary term, it implies the *closed* character of space-time. When the “1” is used for the parts, e.g. as SI units, this automatically implicates that these subsets are also closed. This is, however, not true - all systems and levels are open and exchange energy (7. & 8.). The transformation of energy from one form into another is a ubiquitous phenomenon that cannot be ignored. Any rejection of this phenomenon leads to a complete agnosticism in physics. All physical events are energy interactions. The very existence of organic life, including human beings with consciousness, is based on metabolism, which is a specific form of energy exchange with the surroundings. This has been discussed with respect to vision and spatial perceptions. Without energy exchange, there will be no consciousness to reflect on nature (mathematics, science etc.) and its own existence (philosophy, eschatology).

The *abstract* assumption that the systems and levels of space-time are closed is a *necessary* prerequisite within mathematics. This formal approach allows the comparison (measurement) of actual space-time quantities in terms of *real* numbers. Precisely for this reason, these numbers are defined as **closed** numbers in the new axiomatics. All mathematical presentations in physics use real, closed numbers. Whenever transcendental numbers, such as *pi*, are employed, they are presented as real numbers and not as *uncountable* transcendental approximations as originally defined by Cantor. Mathematics has virtually no method how to employ transcendental numbers in routine calculations.

Contrary to the real numbers, we define the *transcendental* numbers as **open** numbers - each transcendental number has *infinite* approximations. These numbers assess adequately the infinite energy exchange between the systems and levels of space-time (see below). The “mathematical transcendence” is an intuitive perception of the *physical transcendence* of space-time exchange. The set of real numbers is an N-subset of the set of transcendental numbers (U-set), which is obtained when the infinite approximation is voluntarily stopped. There are infinite numbers between any two real numbers which do not belong to these numbers (see footnote 60.). For this reason, the set of real numbers is *discontinuous*. The set of transcendental numbers is, on the other hand, **continuous** and **closed** at the same time. Any transcendental number contains infinite approximations that are closed, real numbers and an infinite quantity of additional transcendental numbers. Transcendental num-

bers are U-sets - they contain themselves as an element. For this reason, we call them open numbers. The set of all transcendental numbers contains simultaneously the infinite small and the infinite great. The same is true for any transcendental number as a mirror image of the continuum. This argumentation is essentially tautological and this fact confirms the closed character of space-time. In this discussion, we should be aware of the fact that any basic mathematical concept, such as the set of transcendental numbers, is an abstract idea of the whole and can be substituted by any other term. Such ideas cannot be confirmed within the system of mathematics (Gödel's theorem). Any mathematical attempt in this respect will be a Sisyphean task. From this elaboration, we conclude:

The **continuum of transcendental numbers** is an equivalent concept of space-time in terms of the new axiomatics and the theory of sets<sup>64</sup> - it is *closed* and *continuous*.

The "continuum hypothesis" as embodied in Russell's antinomy is an imminent aspect of the set of real numbers. It is an *artefact* which disappears as a problem, as soon as the continuum is regarded as a set of open U-subsets,

---

<sup>64</sup> *Cantor*, the founder of the theory of sets, was the first to postulate the existence of transcendental numbers which cannot be counted. He defines the continuum as the set of all numbers which can be counted (real numbers), and all hypothetical numbers which cannot be counted. He calls the latter *transcendental numbers*. Such numbers were only later introduced. Thus Cantor distinguishes for the first time between infinite sets which can be counted (the set of all real numbers) and sets which cannot be counted (the set of all transcendental numbers). Before Cantor, there was no way of discriminating between mathematical infinities. The introduction of transcendental numbers is done on an *a priori* assumption that the continuum is *discrete* (*inhomogeneous*), but *continuous* (principle of last equivalence). Thus the continuousness is a property of the set of transcendental numbers, which Cantor projects on the continuum; the latter contains per definition also the set of closed real numbers. Cantor substantiates this property of the continuum with the properties of geometric structures, for instance, with the continuousness of all points which build a straight line. As geometry appears to be a subset of mathematics and subsequently of the theory of sets, Cantor's proof is *vicious*. The same holds for any mathematical proof of the continuousness and infinity of the continuum. The properties of the primary term can only be comprehended in philosophical categories. Such *a priori* ideas should be confirmed by *empirical* results in a secondary manner. This is the objective of the new axiomatics. As mathematics is a hermeneutic discipline without an external object, neither Cantor's theory of sets nor any further development in mathematics can define the primary term within the system of mathematics and prove its validity (Gödel's theorem). The validity of mathematics is *a priori* postulated - this is the topic of the famous "continuum hypothesis", of which there are different versions (see vol. I).

such as the set of transcendental numbers. The solution of the continuum hypothesis is, in fact, a rejection of the discontinuous set of closed, real numbers as an inadequate reflection of space-time. The reason why we reject the real numbers is based on experimental evidence - all systems and levels of space-time are open U-subsets. With respect to physical evidence and human existence, we cannot ignore energy exchange, as it is the primary term. The very existence of consciousness, from which mathematics emerges as a secondary metaphysical product, is the ultimate proof that all systems are open and exchange energy. The elimination of closed, real numbers from the continuum can neither be justified on mathematical grounds, nor can there be any mathematical arguments against their elimination - this decision is beyond the reach of mathematics. It is the missing existence proof for its validity - mathematicians should be happy about that (see also German vol. I).

In this context, it is remarkable that the conservation of energy can only be formulated for closed, conservative systems. According to the general belief, such systems do not have any energy exchange with their *surroundings*. Unfortunately, physics is fairly vague on what we should understand under the common physical term "surroundings". Personally, I have not been able to find any textbook on physics that explains what the term "surroundings" really means, and I am eager to meet a person who could prove that this term is different from the primary term of space-time (see also discussion on entropy in chapter 5.6 & 5.7). According to the new axiomatics, the only closed system is the universe (space-time), while all its systems and levels are open and exchange energy (space-time). Thus the conservation of energy as assessed by the first law of thermodynamics is a property of the whole which is manifested through its parts (U-subsets). In order to define the conservation of energy, that is, the closed character of space-time, we need not the abstract idea of closed, conservative systems, such as *elastic collision*, *frictionless pendulum* (simple harmonic pendulum), *Carnot cycle*, *blackbody radiation* etc., which are N-subsets of the whole. These are basic conceptual devices in conventional physics, with which nature is explained from a local, operative point of view. Such ideas are fundamental cognitive *inconsistencies* that hinder the development of a unified theory of physics. After their vicious ontology has been thoroughly explained, they **are eliminated** from the new axiomatics. On the other hand, the very presence of such concepts in physics confirms that it is impossible to explain the phenomenology of the physical world, unless we have an intuitive idea of the primary term. In this case, we should solve the problem in a rational and logical manner - as is done in the present axiomatics. Physics does not need Freud to analyse the misguided sub-consciousness of scientists.

From this survey, one may gain the impression that the number "1" is a unique symbol with extraordinary properties. According to the principle of last equivalence, it can be used as a symbol for the primary term. At the same time, it is a symbol of mathematical reciprocity, while the latter is an abstract

idea of the real reciprocity of the two constituents, space and time. The application of this reciprocity to the primary term involves the principle of last equivalence and produces two further concepts - "zero" or the „infinite small number“, and the "infinite great number" or "infinity". As already shown, these are equivalent precepts of the primary term expressed in symbols. With these two symbols, the continuum and the probability set can be fully described for the purposes of mathematics. For this purpose we shall elaborate the physical and cognitive background of the primary number "one".

The number "1" can be formally regarded as a fixed point in the continuum. The expression: all numbers greater than "1",  $n > 1$ , reflects the *macro-infinity (macrocosm)* of space-time when  $n \rightarrow \infty$ ; the expression: all numbers smaller than "1",  $1/n < 1$  evokes an idea of the *micro-infinity (microcosm)* of space-time:  $1/n \rightarrow 0$ , when  $n \rightarrow \infty$ . This mathematical presentation is a tautology of the closed and reciprocal character of space-time. However, we do not have any other expression or definition - no matter how clever or sophisticated it maybe - that contains more information or knowledge on the primary term than its equivalent mathematical precepts based on these symbols - the continuum and the probability set.

When the microcosm and macrocosm are put together, their product is the constant, closed space-time as expressed by the same number:  $1/\infty \times \infty = 1$ . The "one" can be used for the primary term or any subset thereof as the certain event or a unit. All these properties of the number "1" reflect the nature of space-time. The "1" as a symbol is a mathematical tautology of the primary term (1. & 2.). Is it then justified to regard this number as a unique symbol in mathematics, or can we use any other real rational number to substitute the "one"? The answer is fairly simple and straightforward, it follows from the primary axiom: the number "one" is a pure *convention* of mathematics, which has been established in the history of this hermeneutic discipline of correct thinking, and can be substituted by any other number (principle of last equivalence). This is the degree of mathematical freedom.

The "1" seems to play an exclusive role only in respect of the *integers* 1,2,3... $n$ . By building their reciprocal values, we obtain  $1/1, 1/2, 1/3... 1/n$ , where  $n \rightarrow \infty$ . This mathematical procedure engenders the idea of the infinite small number. It can be applied to any other series of numbers. The building of reciprocal values is a division of the "one" with any other real rational number, such as  $1/2, 2/2, 3/2...n/2$ , where  $n$  is an integer. In this case, we obtain for the reciprocal values:  $2/1, 2/2, 2/3...2/n$ , where  $n \rightarrow \infty$ . These infinite series of real, rational numbers result from the building of reciprocities, by using the number "2" instead of the number "1". Reciprocity is the building of relationships. As all numbers are relationships *per se* (principle of circular argument), it does not make any difference, which number we choose

as a reference number<sup>65</sup>. The only rule we should observe in this respect is not to change the reference number within the system. If we decide to express the intrinsic reciprocity of space and time with the number “one“, we must proceed with this reference number in all subsequent mathematical operations. We may alternatively decide to use the number “2“ for building numerical reciprocities. In this case, we should proceed with this procedure in a self-consistent manner throughout the whole system of mathematics and physics. Only in this way can we avoid the occurrence of contradictions and inconsistencies. In this respect, the formalistic principle of self-consistency is operational continuousness of space-time.

As we see, it is possible to use any number of the continuum as a fixed point and acquire the reciprocity of the infinite small number and the infinite great number, with the help of which the continuum and the probability set are conceptually introduced (principle of circular argument). The primary notion of infinity, which is equivalent to the concept of the continuum - *continuous infinity = infinite continuum* - can be expressed mathematically by any subset of the primary term. The reason for this is that all subsets of the continuum contain its properties as an element (U-sets). This insight is contrary to the conventional approach in mathematics, namely, to define the continuum through the number - the whole is defined through its parts. In the new axiomatics, all levels and systems of space-time, and all abstract quantities of space-time, such as charge, mass etc., are regarded as U-subsets of space-time and are axiomatically derived from the primary term. Its mathematical expression, the universal equation, called the Universal Law, is valid for all subsets of space-time.

**38.** The **three symbols** of the new physical axiomatics are:

$f$	-	(absolute) time
$[nd-space]$	-	space
$SP(A)$	-	any physical quantity as a probability; In particular, this symbol is reserved for mass $m$ and charge $Q$ .

---

<sup>65</sup> The continuum of negative numbers, being a mirror image of the continuum of real numbers, is another intuitive notion of the reciprocal character of space and time, or the LRC of contiguous levels (43., 44., 45.). The continuum of negative numbers is a *creative* abstraction of the reciprocity of space-time, which is based on the number “zero“ as a fixed point of mathematical reciprocity. The “0“ is, in fact, an abstraction (a limit) of the “infinite small number“ - all real space-time relations are greater than “0“. The abstract concept of zero is false in real terms - it has no physical correlate - and is eliminated in the new axiomatics. For mathematical purposes, this symbol can still be used, provided mathematicians are aware of its epistemological background (see 48.).

With these symbols one can acquire the following combinations (presentations) within the framework of mathematical formalism:

$$\begin{aligned} [nd\text{-space-time}] &= [nd\text{-space}]f = SP(A)[nd\text{-space-time}] = \\ &= \text{space-time} = \Sigma = 1 \end{aligned} \quad (38-1)$$

$$\Sigma f \leq 1 \quad \Rightarrow \quad 0 \leq SP(A) \leq 1 \quad (38-2)$$

$$\Sigma [nd\text{-space}] \leq 1 \quad \Rightarrow \quad 0 \leq SP(A) \leq 1 \quad (38-3)$$

$$\Sigma K_{1,R} \leq 1 \quad \Rightarrow \quad 0 \leq SP(A) \leq 1 \quad (38-4)$$

where:

$$K_{I,R} = \frac{E_I}{E_R} = \frac{E_{AI}}{E_{AR}} = \frac{SP(A)[nd\text{-space}]f_I}{SP(A)[nd\text{-space}]f_R} = \frac{f_I}{f_R} = \frac{[nd\text{-space}]_R}{[nd\text{-space}]_I} = SP(A)$$

(38-5)

*Explanation:* The above presentations summarize the essence of the new axiomatics in mathematical symbols. The first equation (38-1) says that the product (total set, integral, aggregated product,  $\Sigma$  etc.) of all physical magnitudes that describe space, time, or any other space-time quantity is equivalent to the primary term (1. & 2.). Alternatively, the set of all subsets of the primary term (U-sets) is equivalent to the primary term. This is another variation of the primary axiom. As there are infinite possibilities of subdividing space-time into U-subsets and combining them, there are infinite mathematical presentations of the primary term and its parts - hence the intrinsic propensity of mathematics to develop an infinite complexity of symbolic presentations (25-4). The expressions (38-2) to (38-4) are variations on the same theme. They say that any particular quantity (relationship) of time  $f$ , space  $[nd\text{-space}]$ , or space-time ( $K$ ) can also be expressed as an integral. Such sets have the power of the probability set  $0 \leq SP(A) \leq 1$ . The numerical value of each particular quantity can be regarded as an actual probability.  $K$  symbolizes the coefficients of energy exchange between the levels and systems. These magnitudes are absolute natural constants that assess space-time (energy) as an interacting unity (input-output model). Equation (38-5) summarizes this aspect. It also expresses the reciprocity of its constituents - space and time. Any possible mathematical presentation of a physical law can be reduced to these few fundamental equations, which are variations of the universal equation (18.).

**39.** The *new axiomatics* acknowledges the *creative potential* of mathematical thinking. It is not a particular categorical system, but a **universal method of creating infinite categorical systems** that are always true.

*Explanation:* We shall prove in this volume that the new axiomatics unifies science by incorporating physics, cosmology and mathematics as concrete categorical systems of science, as they have historically evolved. We have also hinted that it encompasses all known religious and philosophical concepts (vol. IV). In volume III, we prove that medicine and bio-sciences, such as biochemistry, physiology, genetics, pharmacology etc., which are particular categorical systems of organic matter, are also part of the new axiomatics. The same applies to economics. All scientific disciplines are incorporated into the new axiomatics. This is the **unification of science under one principle: one term**<sup>66</sup>.

**40.** Each system (action potential), the space-time of which is different from the mean space-time of the corresponding level, can be defined as a basic system (action potential) of a new level (6.). The systems of a level can be considered to be mathematically equivalent (equipotent) according to one criterion and **non**-equivalent according to another. The choice of the criterion is an *arbitrary, subjective* decision of the human mind.

*Explanation:* One can consider the apples in a basket as equivalent systems and count them by assigning the number “1“ to each one of them. In this case, the basket is a class (set, level) of equivalent elements, called “apples“. As no two apples are absolute equivalents, this is an arbitrary criterion that allows the application of mathematics (counting, addition etc.). If we use instead the weight of the apples as a criterion for building a set of equivalent objects, we obtain different sets of apples depending on the weight, which we have voluntarily selected as a criterion for the building of a set. This process of discrimination is *infinite* - hence the infinity of levels and systems of space-time. **Space-time is transcendental in real and conceptual terms.** The building of any categorical system depends on the method of measurement (19.) - on its definition and degree of precision. These are subject to the free will of

---

<sup>66</sup> The new axiomatics is the accomplishment of *Aristoteles*' attempt to develop a universal system of science. He begins with the definition of a *term*. The Greek word is “*eidos*“ (idea), which means “*form*“ - hence *Aristoteles*' *theory of forms*. Human thinking evolves in terms, ideas, forms. But what is a term? According to *Aristoteles* each term has two aspects: it must assign a real object to a class of objects and at the same time define the class in terms of the objects. We use the same method to define a system, a level, or an action potential of space-time. *Aristoteles* specifies ten basic categories, which are sufficient to describe any object and its corresponding class. These are: substance, quantity, quality, relation, where, when, place, possession (have), action and effect. It is easy to perceive that these categories, which are basic to any scientific system that has been developed since *Aristoteles*, can be deduced from the primary term. This fact underlines the epistemological simplification which the new axiomatics brings.

the mind and its inherent striving for a greater precision<sup>67</sup>. The historical evolution of the SI system is a typical example for this tendency<sup>68</sup>. The general theory of relativity is also based on this insight - without the introduction of the abstract concept of “inertial reference frames“, the famous *equivalence principle* of this theory, being a one-sided interpretation of the principle of circular argument, would have made no sense (see section 8.). This has not been fully appreciated by Einstein or any other physicist after him.

Each criterion for building a categorical system is itself an abstract U-subset of space-time and can be substituted by any other criterion. From this, we conclude that any concrete categorical system is a *relative approximation of space-time* and can be substituted by any other system (*principle of relativity* in human thinking). We can observe this in the history of science. Only the primary term cannot be substituted by other criteria or terms because according to the primary axiom they will be equivalent<sup>69</sup>.

This **predetermines** the universal character of the new axiomatics, which is not a fixed categorical system, but a universal instruction how to create such systems - the new axiomatics is **operational mathematical consciousness**.

---

<sup>67</sup> It is quite amusing to witness how some physicists try to find a “systematic“ failure in the calculations presented in vol. I & II and how earnestly they believe that they can reject the existence of the Universal Law on this ground. Such persons do not realize that the precision of the mathematical examples presented in the new axiomatics depends on the precision of the results published in the literature; these can be voluntarily approximated in many different ways by using closed real numbers. As space-time is the set of all numbers, or more precisely, the set of transcendental numbers, the numerical values of the derived constants are approximated real numbers of transcendental magnitudes. The experimental confirmation of the results presented in this book, especially the astounding number of new derivations, should, however, satisfy the expectations of the most fanatic empiricists. As the majority of physicists belong to this group, this may be practical utilitarianism (see Bentham’s view in favour of general happiness as *summum bonum*), but it has nothing to do with the acquisition of true scientific knowledge.

<sup>68</sup> The introduction of *irrational numbers* stems from the knowledge of the *incommensurability* between the diagonal and the sides of a square. The importance of this fact was already acknowledged by Plato. The striving for precision in geometry inevitably leads to the introduction of new mathematical symbols, which express more precisely the incommensurability of space quantities than integers. This fact is not fully appreciated by most physicists.

<sup>69</sup> However, the substitution of one categorical system with another does not pre-suppose that these systems are true - in fact, none of the categorical systems which mankind has developed so far are consistently true. This explains the intellectual and political confusion in present-day society, which merely reflects the low level of evolution of individual and collective consciousness at this particular period of human history.

*Example:* The *standard model* of physics explains nature in terms of a few elementary particles (quarks, leptons and their antiparticles). This is a continuation of *atomism* as the prevailing *weltanschauung* in physics. As there can be no physical definition of what is elementary and what is complex, the criterion for “elementariness“ in the standard model is the *space-scale*: systems with the smallest extent are considered to be the most elementary and vice versa. This criterion ignores the well-known fact that the greatest energy is contained in particles with the smallest extent due to the reciprocity of space and energy ( $E \approx f = 1/[space]$ ). The “infinite small“ as space (extent) contains the “infinite great“ as energy and vice versa - the “infinite great“ as space contains the “infinite small“ as energy.

Trivially speaking, space-time must be organized in a more complex (dense) way in the microscopic space of the so-called “elementary“ particles. The liberation of this energy, described as nuclear explosion, could be very well explained in terms of diminishing complexity (diminishing order of spatial organisation). In fact, we are not allowed in physics to make any qualitative judgements on space-time and its parts, but only quantitative assessments. The only possible conclusion is that space and time, respectively, energy, are canonically conjugated, reciprocal quantities of the primary term. This simple axiomatic approach rejects the mechanistic, deterministic approach of the standard model as *reductio ad absurdum*. This conclusion is substantiated by the observation that the idea of “elementariness“ inevitably implies the idea of *indivisibility*. Indivisible physical systems are homogeneous, they cannot be quantized. This is against all physical evidence. Theoretically speaking, elementary particles should not interact because they are unchangeable. If they do, they will change. Such particles cannot be elementary, at least, in the sense of the standard model. Evidently, we can discard the standard model with logical arguments, without having a detailed knowledge on quantum physics. At the same time the new axiomatics confirms the results of QED, QCD and GUT (see chapter 7.4).

41. We substitute the symbol for  $m$  with the general symbol for probability:

$$m = SP(A) \quad (41-1)$$

*Explanation:* Mass is defined in mechanics as “the intrinsic property of an object that measures its resistance to acceleration“.<sup>70</sup> This is a vicious, circular definition of Newton’s Second Law  $F = mg$  (where  $g = a$  is the acceleration of the earth’s gravitation), as both *force* and *acceleration* are conceptual subsets of the primary term. The new axiomatics clearly states that the only possible definition of a physical quantity is its method of measurement (19.). The mass scale is set up by choosing one particular object as a standard and

---

<sup>70</sup> PA Tipler, p. 80

assigning it a mass of 1 *unit* (= the certain event). The international standard object is a cylinder of platinum alloy carefully preserved at the International Bureau of Weights and Measures at Sèvres, France. The mass of this standard object is called 1 *kilogram* (SI unit). The standard object is used to produce secondary standards by comparison (equivalence, principle of circular argument), with which the mass of any object can be compared (building of relations). The conventional mathematical presentation of the method of mass measurement is based on Newton's Second Law, but it can be directly derived from the primary term:

$$\frac{m_1}{m_R} = \frac{m_1[\text{kg}]}{1[\text{kg}]} = m_1 = \frac{F_1 g}{F_R g} = \frac{F_1}{F_R} = \frac{F_1 s}{F_R s} = \frac{E_1[\text{J}]}{E_R[\text{J}]} = \frac{E_1}{1} = K_{1,R} = SP(A)$$

(41-2),

where  $m_R$  is the reference mass of 1 *kg* (Recall: any quotient of equal quantities is a pure number.). If we assign the distance  $s$  the SI unit of 1  $m$ , we can use either  $F$  or  $E$  as a symbol for the space-time of the objects:  $E = Fs = F \times 1 = F$ . This is our degree of mathematical freedom. We shall show throughout this volume that the use of the primary number "1", either as a unit or the certain event, is the only method of creating new abstract subsets of the primary term within mathematical formalism (37.). These subsets are conventionally regarded as "distinct" physical quantities, such as mass, acceleration, force, momentum etc., that really exist. As the number "1" is the origin of the continuum  $n$  and the probability set  $0 \leq SP(A) \leq 1$ , it is also the origin of any physical quantity which can also be expressed as a number  $n$  or a probability  $SP(A)$ .

Equation (41-2) is an iteration of equation (38-5), which we have axiomatically derived from the primary term (see also equations (27-1) and (35-1)). It confirms that the space-time of a particular system can only be assessed as a relationship to the space-time of a reference system. This quantity is called "mass" in traditional physics. The principle of circular argument is ubiquitous due to the closed character of space-time. Although mass is traditionally defined through acceleration - as the intrinsic property of the object to resist acceleration - equation (41-2) does not contain this quantity. This is the reason why mass is considered to be an immanent property of matter which does not depend on the location of the object, e.g. earth, moon or any other place. The location is, however, intrinsically linked to the local gravitational potential and acceleration. Apparently, there is a paradox in the traditional interpretation of mass which cannot be solved in classical mechanics (see also chapters 3.8 & 3.9). In the new axiomatics, mass is a relationship of the space-time of gravitational systems. As each system can be regarded as its own action potential, it has a specific *constant* space-time (14.). The same is also true for any quantity of

space-time (33.) - hence the *constant* mass of an object which is independent of place. This is an axiomatic explanation. Traditional physics, on the contrary, is quite vague on this issue - it gives us no explanation what the quantity “mass“ really means. This quantity will be discussed on many occasions in the present volume.

**42. The axiom of reducibility** is a fundamental axiom of application of the new axiomatics (19.). It says:

Any energy exchange in space-time can be regarded as an *interaction* between **two** entities (systems or action potentials). Any energy interaction engenders a **new entity**, the space-time of which is the **product** of the space-time of the two interacting entities.

$$E = E_1 \times E_2 = E_1 E_2 \quad (42-1)$$

If there are  $n$  entities that interact, as is the case in space-time, we can always aggregate these entities to two sets (U-sets) which can be regarded as distinct interacting entities. This is the degree of mathematical freedom of our consciousness - it is the origin of different physical laws of present-day physics.

*Explanaton:* The axiom of reducibility is the core of all physical laws which have been conventionally derived in physics. Any experiment can be mathematically described with this axiom. As the elaboration of natural laws and their applications usually takes place within the framework of geometric formalism, there is a recurrent pattern of how physical laws and quantities are spatially expressed. We shall now discuss their ontology in detail.

Consider an object at rest with the mass  $m$ . When this object moves in space-time, it acquires an additional energy (space-time) which can be assessed by the one-dimensional quantity of space-time - velocity  $v = [1d\text{-space-time}]$  (21.). According to the axiom of reducibility, we can regard the mass  $m$ , which is a quantity of the space-time of the object at rest  $E_r$ , as a distinct entity and the space-time of its displacement  $E_k$  (motion is always a product of another interaction, which we disregard for the moment) which is measured by velocity as another distinct entity. The product of the space-time of these two interacting entities,  $E_r$  and  $E_k$ , gives the total space time (energy) of the moving object  $E$ . By applying the *axiom of reducibility*, we obtain the **momentum** of the object, which is a fundamental quantity in classical mechanics:

$$E = E_r E_k = mv = SP(A)[1d\text{-space-time}] = \text{momentum} = p \quad (42-2)$$

Momentum is a composed quantity which assesses the space-time of moving objects. In the theory of relativity, the space-time of moving objects is given as *relativistic momentum*, *relativistic energy*, or *relativistic mass* in Lorentz

transformations. We shall show that these transformations are mathematical iterations of the probability set (equation (43-4) & section 8.).

The epistemological background of momentum is determined by its method of measurement (19.). As this aspect is totally neglected in conventional physics - the most evident fact is evidently the most likely to be overlooked -, we shall discuss it on many occasions in this volume. We call this human trait the “*vicious circle of omission*.” Momentum is a quantity of the motion of gravitational objects. To understand this abstract term, we have to consider how motion (displacement) is currently assessed in physics. The reference frame within which motion is measured is Euclidean space, [*3d-space*]. For practical purposes, e.g. an illustration on a sheet of paper, usually a [*2d-space*] is used. Within this geometric formalism the secondary terms, *vector* and *scalar*, are introduced. Both terms are abstract concepts of mathematics (definitions through abstraction) which have no correlates in the real world. A point is called a scalar in physics. When it moves in Euclidean space, it is described as a *displacement vector*, which is a straight line with a direction (an arrow). This is simple geometry based on unclear primary terms, such as point and line. The magnitude of a vector is a pure number - it is a relationship with the *unit vector*. Vectors can be measured in terms of geometry or calculated as numbers. The physical point is a *mass point*, also called a *centre of mass* or *point particle*. This term is a pure abstraction of the space-time of material objects which is obtained by means of geometry or integral calculus (see standard textbooks on this issue and chapter 3.1). A mass point has no extent and therefore no space-time - if [*space*] = 0, then  $E = [\textit{space-time}] = 0 \times f = 0$ . However, all real physical objects have a space-time and therefore an extent. To bear this difference in mind is the highest precept in physics. Unfortunately, it is the most neglected one in physical geometry. As all objects are in relative motion, the mass point, being a scalar, has to be presented in a process of displacement. The product of a point particle, which is a scalar, and its velocity, which is conventionally defined as a vector, is arbitrarily defined as a vector. This is how momentum is obtained:  $p = mv = \textit{vector}$ . There is no epistemological necessity for this purely geometric definition, which is based on an abstract discrimination between two unclear geometric terms, point and straight line. According to Hilbert, we could as well substitute scalar (point) and vector (straight line) with the terms “beer mug“ or “chair“, without changing the content of physics. Formally regarded, momentum is composed of a scalar and a vector, where the scalar (mass point) dissolves in the vector (velocity) to produce a common vector. The semantic absurdity of this geometric explanation is more than evident. The physical object in motion as described by its momentum is a unity. We cannot separate its mass from its motion. It was precisely the insight into this fact that forged the development of the theory of relativity. All systems of space-time are in motion because they participate in incessant energy exchange. Velocity is the universal manifestation of this exchange. Momentum is a secondary quantity of this

energy exchange, which is obtained by applying the *axiom of reducibility* (42-2) - therefore it is an U-subset of the primary term.

We can substantiate this conclusion with a key law of classical mechanics. We can regard the space-time of an object as its own action potential (14. & 15.). In this case, we conclude axiomatically that its momentum is also *constant* (33.). This is an aspect of the closed character of space-time which is manifested as a property of the parts. This axiomatic conclusion is known as the **law of conservation of momentum**. This basic law of mechanics is formulated for conservative systems, where the term “conservative“ is a synonym for “closed“, for instance, it is believed not to hold in dissipative systems:

$$P = \sum m_i v_i = \text{cons.} = \text{space-time} \quad (42-3)$$

The sum of all momentums in the universe results in space-time (1.) Equation (42-3) is not only an iteration of the primary axiom, but also a concrete application of the *axiom of conservation of action potentials* (34). In this case, space-time is regarded as an interaction with itself (as an action potential that interacts with itself due to its closed character):

$$E = E_A = E / E_A = f = 1 = \text{the certain event} = \text{cons.} \quad (42-4)$$

Equation (42-4) is another example of the fundamental tautology of the primary axiom which can be traced down to any particular physical law, such as the conservation of momentum.

Momentum is a preferred quantity by the formulation of physical laws in mechanics. This quantity appears under the concept of “elastic collision“. This term implicates energy conservation between two objects which build a closed (conservative) system. This idea is a fundamental cognitive blunder which is propagated throughout the entire edifice of physics. No subset of space-time can be closed - all systems and levels are open (7.). Only space-time is closed (4.). The application of the concept “elastic collision“ for conservative systems is a projection of the intuitively correct idea of the closed character of space-time onto the parts, which are open and exchange energy. Therefore it must be rejected as a false concept that hinders the perception of the Universal Law. All collisions between two material objects are *open* and *dissipative*. For instance, a small portion of the friction energy caused by the collision of two approximately elastic balls is transformed into thermodynamic energy, which is emitted as photons (see Stefan-Boltzmann law and Wien’s displacement law of radiation). We shall prove in this volume that photons also have a mass because this quantity is an energy relationship. On the other hand, light or photon mass disperses in the universe. From this example, it should be clear why elastic collision between two material objects is a naive notion of the clo-

sed character of space-time, which is erroneously applied to its subsets. This is the classical vicious circle one always encounters in traditional physics.

Elastic collision is a hidden application of the axiom of reducibility. If the space-time of two interacting entities,  $E_1$  and  $E_2$ , are described in terms of momentum,  $m_1v_1$  and  $m_2v_2$ , the product of their space-times gives the space-time of the resulting entity<sup>71</sup>:

$$E = E_1E_2 = m_1v_1 m_2v_2 = \\ SP(A)_1[1d\text{-space-time}]_1 \times SP(A)_2[1d\text{-space-time}]_2 = mv^2$$

or

$$E = SP(A)[2d\text{-space-time}] = E_A f \quad (42-5),$$

where  $m=m_1m_2$  and  $v_r=v^2=v_1v_2$  (e.g.  $25=5^2=9 \times 16$ ;  $v_r$  is resultant velocity, see principle of last equivalence). From this we follow:

Equation (42-5) is a novel presentation of the **universal equation of space-time** within the framework of geometric formalism in traditional physics. This [2d-space-time]-presentation can be substituted by any other spatial presentation with  $n$ -dimensions.

From equation (42-5), we acquire for the **action potential** the following space-time presentation, which is a common quantity in many physical laws:

$$E_A = E/f = SP(A)[2d\text{-space}]f = SP(A)[1d\text{-space-time}][1d\text{-space}] \quad (42-6)$$

The *two-dimensional space-time* presentation of the energy of the resulting system (entity) is a product of the *one-dimensional* expression of the space-time of the two interacting entities as *momentum*: two vectors, described as *lines*, are multiplied to give a *two-dimensional* spatial presentation of space-time as **area**. Within the framework of geometric formalism, space-time exchange is described as “**area in motion**“. This presentation results from the method of measurement (Euclidean space). “Area in motion“ is another intuitive idea of the Universal Law which is frequently used in the formulation of specific laws. It can be regarded as a variation of the abstract idea “elastic collision“. For instance, the laws of electricity are ontologically derived from this paradigm. We shall prove that *charge*, another fundamental quantity of physics, is a **synonym for area**, while the SI unit for charge, 1 *coulomb*, is equivalent to 1 *square meter*. This embarrassing pleonasm has been overlooked so far.

According to the new axiomatics, all  $n$ -dimensional presentations of space or space-time are equivalent (21-2). In their traditional expression, the laws of mechanics usually describe space-time (energy) as an interaction between

<sup>71</sup> The product of two probabilities is also a probability:  $p = p_1p_2 = SP(A)_1SP(A)_2 = SP(A)$ .

objects, which are formally regarded as mass points or “mass particles in motion“. Therefore, such laws axiomatically end up with a two-dimensional presentation of energy. This is a recurrent motif in physics. Purely for this reason, we express the original universal equation  $E = E_A f$  which we have axiomatically derived from the primary term as  $E = SP(A)[2d\text{-space-time}]$ . This is a voluntary decision within geometry which facilitates the derivation of conventional physical laws from the Universal Law. The new space-time presentation of physical laws in the new axiomatics is a consequence of the traditional method of measurement in physics (19.). It can be substituted by any other axiomatic expression. The new axiomatics is, firstly, a hermeneutic formalistic unification of physics, as it has historically evolved to its present state, and, secondly, a further development of physics. This will be confirmed by the derivation of many new constants that enlarge our physical view of the world.

**43.** The new term “**long range correlation**“: It is up to the *free will* of the mind to regard the space-time (energy) of each particular system or level as a **static** entity which does not participate in energy exchange. The abstract concept of **static systems** that do not enter in interactions occurs within mathematics (method of definition, 19.). The space-time of the system is regarded as a *potentiality* which can be transformed into an *actuality* (exchange) at any time by the free will. Note: This conditional arrest of energy exchange occurs in the mind and not in the real world, which is incessant energy exchange. According to the axiom of reducibility, any system can only be assessed as a result of the interaction between two entities (42.), and any assessment is an interaction *per se*. If we assume that a system is not interacting, for example, if we take a capacitor potential which does not discharge, we can only describe its space-time if we compare it with itself. Any other measurement will be a discharge<sup>72</sup>. However, a self-comparison is also an interaction - it is a metaphy-

---

<sup>72</sup> We must be aware of the fact that there is no possibility of measuring a capacitor potential, which is stored electromagnetic energy, without building an electric circuit that measures the voltage. This is already an interaction between a capacitor and a voltmeter. Without any measurement, there will be no information on space-time relationships. This is the actual function of human perceptions. Technical experiments are mere prolongations of human perceptions. Any instrumental or perceptive interaction with space-time follows the Universal Law. However, to assume that human knowledge can only be acquired in homoeopathic empirical portions, while consciousness is *a priori* void of knowledge, is the greatest fallacy of modern empiricism since Locke, Berkeley and Hume. The development of mathematics from prehistoric times to the present day is a proof that consciousness perceives nature in terms of the Universal Law without performing basic scientific research to find out what „holds the pieces together“ (Goethe). This has been anticipated by Leibniz in his *monadology*, as well as by Russell and Whitehead in their system of hierarchical types (*Principia mathematica*). Empiricism as a philosophical view preaches a profound agnosti-

sical interaction which occurs in the mind; it produces a number of fundamental quantities (terms) in physics, such as *relativistic mass at rest*, *potential energy*, *electric potential* etc. (see below). This mental procedure follows the principle of circular argument and is equivalent to the definition of the certain event (37.). It can be applied to any quantity of space-time (U-subset), for instance, to the quantity “mass“. In this case, the mass of the system which is expressed as a probability  $SP(A)$  is compared with itself,  $m/m = SP(A)/SP(A)=1$ , to give the certain event:  $SP(A) = 1$  (see equations (41-1) & (41-2)). If we set this probability in the space-time presentation of the universal equation (42-5), we obtain axiomatically the following new term (quantity):

$$\begin{aligned} E_{static} &= [2d\text{-space-time}] = \text{long range correlation (LRC)} = \\ &= \text{gradient} = \text{potential} \end{aligned} \quad (43-1)$$

*Explanation:* The term “**long range correlation**“, which is also used in traditional physics, acquires a new definite connotation in the new axiomatics.

The new term **long range correlation, LRC**, is axiomatically derived from the primary term - it is an abstract U-subset of space-time when the latter is regarded in a static way, that is, energy exchange is *mentally* eliminated (arrested). The method of definition and measurement of this abstract quantity is **mathematics** - in this case, the mass of any particular system is defined as the certain event:  $SP(A) = m = 1$  or **1 unit**.

We introduce this term for practical reasons - there are many different quantities in physics which are pleonasm of LRC. For instance, the traditional terms, *gradient* or *potential*, in electromagnetism are synonyms of LRC. This new universal term affects a great simplification in physics.

*Examples:* Each system or level has a specific LRC, which is a natural constant. For instance, *Einstein's equation*  $E = mc^2$  is a concrete application of the universal equation (42-5) for the photon level:

$$E = mc^2 = SP(A)[2d\text{-space-time}]_p = E_A f \quad (43-2),$$

---

cism and paves the way for mysticism, obscureness and short-sighted actionism. The new axiomatics rejects empiricism in this extreme form, but it confirms the necessity of performing *creative* research for the benefit of society (and not for its annihilation, as is the case of military research). Any true scientific research must adhere to the Universal Law and improve the chances of mankind's survival, which are now rather bleak (see chapters 13.7 & 13.10 in vol. I and chapter 2.9 in vol. III).

when the axiom of reducibility is applied for this level (42) - hence the universal character of this simple equation. The space-time of the photon level can also be regarded in a static way. Its  $LRC_p = [2d\text{-space-time}]_p = c^2$  is **constant** because the velocity of light is also a constant. We may also say: the *potential* of the photon level is a natural constant. This knowledge is not unfamiliar to physics, as it may seem at first glance: in classical mechanics, the photon level is described through the *gravitational potential*  $U_G$ , which is LRC per definition. Gravitation (presented as acceleration) is constant for each system, for instance, the earth's gravitation is constant:  $g = cons.$

Philosophically, gravitation is regarded as an *action at distance*, sometimes the synonym "long-range correlation" is used. Both terms cannot be explained in physics from an epistemological point of view. This has hindered an understanding of gravitation. Another synonym for LRC is the "field". It is used in conjunction with gravitation and electromagnetism. Field is an abstract mathematical device (lines, vectors in geometric space) which describes gravitational and electromagnetic interactions as long-range correlations. This is a tautological statement - gravitational and electromagnetic interactions or fields are LRC, therefore, they can be regarded as potentials. With the introduction of the new term LRC which is directly derived from the primary term we eliminate such tautological statements and demythologize physics as a simple axiomatics of the mind.

Traditionally, Einstein's equation is considered to be of universal character - it is believed to assess the equivalence between two distinct quantities: *mass* and *energy*:  $E = mc^2$ . As mass is an energy relationship (chapters 3.8 & 3.9), this fundamental equation is a mathematical pleonasm (vicious circle)<sup>73</sup>. The reason for the universality of this concrete application of the Universal Law was not understood by Einstein, although its origin was very simple. In his equation, the space-time of the photon level is selected as a *reference* system ( $LRC_p = c^2 = cons.$ ). The space-time of any other system is then compared with it:  $m_s = E_s/c^2 = SP(A)$ , where  $E_s$  is the space-time of any system and  $c^2 = E_p$  is the space-time of the photon level as a reference system. In this case, the mass of the photon level is  $m_p = SP(A) = 1$  (equation (41-2)). This mathematical approach reveals why photon mass is neglected in physics - **it is already in the velocity of light**:

$$E_p = m_p c^2 = SP(A)[2d\text{-space-time}] = [2d\text{-space-time}] = c^2,$$

---

<sup>73</sup> This vicious circle is confounded in the concept of *gravitational* and *inertial* mass, which is central to the theory of relativity. The experimental proof of their equivalence (Eötvös, Dicke et al. etc.) was a superfluous confirmation of a semantic tautology created in the mind. This conclusion is true for most experimental research in theoretical physics - one always assesses the Universal Law under particular experimental conditions (axiom of reducibility).

$$\text{when } m_p = SP(A) = 1 \text{ unit} = 1 \quad (43-3)$$

The quotients built in this way in the theory of relativity are called **Lorentz transformations**. They assess the actual space-time of material systems as  $LRC = v^2$  in comparison with the constant  $LRC = c^2$  of the photon level  $v^2/c^2$ . This quotient is set in relation to the certain event defined as:  $c^2/c^2 = SP(A) = 1$ . This mathematical acrobatics results in another pleonastic presentation of the probability set, called the **Lorentz factor** (see chapter 8.3):

$$y^{-1} = \sqrt{1 - \frac{v^2}{c^2}} = 0 \leq SP(A) \leq 1 \quad (43-4),$$

$$\begin{aligned} \text{when } v \rightarrow 0, y^{-1} &\rightarrow 1, \\ \text{when } v \rightarrow c, y^{-1} &\rightarrow 0 \end{aligned}$$

Equation (43-4) encompasses the entire theoretical background of the theory of relativity and its two fundamental concepts “*mass at rest*“ and “*relativistic mass*“ (see chapter 8.4).

Due to the closed character of space-time, one can only compare the actual magnitudes of space and time, or any other quantity of space-time of one system with the same quantities of another system, or set different abstract quantities of space-time in relation to each other, e.g. force to acceleration  $F/a = m = SP(A)$ , momentum to velocity  $p/v = m = SP(A)$  etc. By establishing such relationships, we always obtain actual numbers of the continuum or the probability set. As all material systems are ultimately transformed into photons and vice versa (open systems), Einstein’s equation is always valid<sup>74</sup>. It is an intuitive perception of the Universal Law. It would have been equally valid if Einstein had defined it for another reference level of space-time (degree of

---

<sup>74</sup> In fact, the equivalence between mass, comprehended as matter, and energy has only been proven one way - from matter to energy, e.g. as *mass defect* in nuclei. Under energy, conventional physics usually understands the space-time of the photon level. This fact explains why photons are erroneously regarded as massless particles (zero rest mass). Only quite recently (Sept 1997) was it reported that for the first time mass particles were obtained from photons. When laser beams interacted with gamma rays, an electron and a positron were produced. This is a prospective experimental confirmation of the fundamental discovery of the new axiomatics, namely, that photons have mass and charge. This semantic discovery is based on the appropriate axiomatic definition of mass and charge as originally introduced in conventional physics: mass is a relationship of the space-time of systems that can be expressed as a probability  $m = SP(A)$ , while charge is a relationship of area  $Q = SP(A)[2d\text{-space}]$  ( $1C = 1m^2$ ); this abstract quantity of geometric origin can also be presented as a probability:  $Q = SP(A)$ , when  $[2d\text{-space}] = 1 \text{ unit} = SP(A) = 1$  (see further explanations below).

freedom). We summarize the key issue of this point: the quantity  $c^2$  is a constant of the photon level and is defined as its LRC. It is the universal reference system in Einstein's theory of relativity. We also call it the **universal potential**  $U_U$ :

$$U_U = c^2 = [2d\text{-space-time}]_p \quad (43-5)$$

**44. The LRC of contiguous levels in a system behave reciprocally.** This practical axiom is a variation of the *axiom of reducibility* (42), according to which each system can be reduced to two levels:

When the LRC of one level augments, the LRC of the other level diminishes and vice versa. This is a consequence of the *reciprocity* of space and time and the conservation of energy. We define this practical observation as an „axiom on the reciprocity of the LRC of contiguous levels in a system“.

The reciprocity of LRC is not a new property of space-time - it is a consequence of the fundamental reciprocity of the two constituents. This is an important observation.

*Explanation:* The reciprocity of LRC is basic to an understanding of the **self-regulation** of organic matter at the cellular level. This issue is partially covered in volume I (see essay under point 48, titled: The reciprocal behaviour of the LRC of the cell, p. 611). A full elaboration of the General Theory of biological regulation is given in volume III of the present tetralogy of science. The reciprocity of LRC is also fundamental for an explanation of the social self-regulation at the macroeconomic level. For instance, the economy can be regarded as a system of two distinct levels - the level of *money supply* and the level of *production* of material and ideal goods. The *cyclic* behaviour of these levels can be explained with the reciprocity of their LRC. This fact has been intuitively anticipated by *Keynes'* theory and *monetarism* - both doctrines are one-sided perceptions of the Universal Law at the macroeconomic level that have been integrated into a **General theory of economic regulation**<sup>75</sup>. This issue is covered in a separate book on modern economic theory.

---

<sup>75</sup> The interventional policy of central banks such as the *Fed* is concrete intuitive application of the Universal Law at the level of finance with a *global effect* on world economy. For instance, the voluntary modulation of interest rates, which can be regarded as a distinct level, has a direct impact on money supply, e.g., higher interest rates lead to “tight money“ and vice versa, and, subsequently, on economic performance. The interrelationship between the two levels, money supply and production, can very well be described by the axiom on the reciprocal behaviour of the LRC of contiguous levels. Consider money supply in Fisher's equation  $M = PT$ , which is an application of the uni-

45. The reciprocal behaviour of the LRC of contiguous levels has been anticipated in mathematics by the introduction of *negative numbers* and *zero*, which are complementary to the continuum of real numbers. Thus the continuum is designed as a formal system consisting of two levels which behave reciprocally - the continuum of positive numbers and the continuum of negative numbers. Zero is an abstract limit (intercept) between the two sets, but this symbol can be substituted by any other number.

*Explanation:* Let us assign any random number to the space-time of a system, say 7. It is a closed number that reflects the constant space-time of the system. Let the LRC of the two levels of this system be expressed by positive and negative numbers, so that the space-time of the system always remains constant. If  $LRC_1 = 14$ , then  $LRC_2 = -7$ . The sum of both LRC gives the space-time of the system:  $E_{cons.} = LRC = LRC_1 + LRC_2 = 14 - 7 = 7$ . When the value of the positive numbers augments  $LRC_1 > 14$ , the value of the negative number should diminish accordingly  $LRC_2 < -7$ , so that the sum does not change. This is the well-known *double-entry bookkeeping*, which is the

---

versal equation ( $P$  is the mean price of transactions, which is constant for any economy, so that  $P = E_A$ , and  $T$  is the number of transactions  $T = f$ , hence  $M = PT = E = E_A f$ ), statically as structural complexity (space)  $M = K_s$  ( $f = 1$ , see 46.) which increases (more money on the market) when interest rates are lowered (monetaristic approach) or taxes are reduced (fiscal approach). In this case, the LRC of the money level  $M = E_{static} = LRC_M$  will diminish (cheap money) because the money potential is inversely proportional to increased money supply (volume, space)  $LRC_M = 1/SP(A)[2d-space] = 1/K_s$ . At the same time, the LRC of the production level will behave reciprocally - industrial production, measured by the energy consumption  $E_p = LRC_p$ , will be stimulated by the “cheap money“ and will grow  $LRC_p = 1/LRC_M$ . This is the classical mechanism of counter-cyclic regulation of stagnating economies, as first suggested by *Keynes*, but it can be applied to any other pair of metaphysical levels of economy, such as fiscal debt, unemployment, effective demand, propensity to consume etc. (for further details see JM Keynes, *The General Theory of Employment, Interest and Money*). Another possible approach to economy is to reduce money supply, e.g., by raising interest rates in a period of inflation, and obtain the reverse effect: a fall in production and a decrease in prices. This voluntary act of modulating the LRC of the system “economy“ is known as the *monetaristic* approach. It always leads to a recession when applied in a pure form (see Milton Freedman, *Money Mischief*, Harcourt Brace, 1994; *Interest Rates and the Demand for Money*, J Law & Econ, 1966; *The Quantity Theory of Money - a Restatement*, in Friedman (ed), *Studies in the Quantity Theory of Money*, University of Chicago Press, 1956 etc.). This is the shortest possible presentation of macroeconomics on the basis of the Universal Law (see my lectures on economics in the Light of the Universal Law). Equipped with the new economic theory of the Universal Law, even a layman will understand economic behaviour better and in a far more rational way than all the specialists on finances that swarm the numerous financial TV-channels and intoxicate the minds of the public.

foundation of any economy. It is the earliest intuitive perception of the Universal Law in the field of economic affairs. Quesnay's Tableau and Leontieff input-output models are further developments of the *double-entry book-keeping*. The link between the Universal Law and the theory of sets, on the one hand, and their practical implementation in daily economic life, on the other, should be thus cogent.

Without any knowledge on the reciprocal behaviour of the LRC of contiguous levels, respectively, of space and time, as mirrored by the continuum, it is not possible to analyse the concept of *increasing entropy* (second law of thermodynamics). We shall prove in chapter 5.6 that this concept is entirely wrong. On the other hand, the mathematical presentations of this entropy law are concrete derivations of the Universal Law. This is true for any mathematical presentation in present-day physics; at the same time, all verbal, non-mathematical interpretation of such mathematical results are entirely wrong.

**46.** The new term “**structural complexity  $K_s$** “: Within the new axiomatics, we shall introduce another fundamental term of universal conceptual validity which is directly derived from the primary term. This term is of immense practical importance. It includes a group of common physical quantities, which are traditionally believed to be distinct entities, although they have the same ontology in the realm of consciousness:

**Structural complexity  $K_s$**  is an abstract subset of space-time. This quantity is actively built in the mind when the constituent *time* is eliminated. The elimination of time occurs within mathematical formalism by giving the number 1 (as a unit or the certain event) to time  $f=1$ :

$$E = E_A f = SP(A)[2d\text{-space-time}] = SP(A)[2d\text{-space}] f^2,$$

$$\text{when } f = SP(A) = 1$$

$$\mathbf{K_s = SP(A)[2d\text{-space}]} \quad (46-1)$$

*Explanation:* Structural complexity assesses space-time as *two-dimensional space* quantity in a static way. In this static view of the world, time is practically **brought to a halt** in the mind. This time *arrest* is accomplished within the framework of mathematical formalism, either by considering the actual time quantity as 1 *unit* or the *certain event*:  $SP(A) = f = 1$ . We have shown that time can be expressed as a probability (38.). For instance, frequency, which is an actual quantity of time, is a relationship of different periodicities (see essay under 24.) - therefore, it is a pure number, which can be presented as a probability. The mathematical procedure of arresting time in

the mind and presenting space-time as geometric space is basic to wave theory (see section 4.).

Let us consider a wave that propagates in a medium. It could be regarded as a distinct entity that spreads with a certain velocity. If we arrest its movement for a while, for example, by making a picture of it, we can describe the wave geometrically in terms of an *amplitude* ( $A$ ), which is a [1d-space]-quantity or a *cross section*, which is a [2d-space]-quantity. Any geometric assessment requires the arrest of motion, which is an intrinsic property of space-time exchange (8. & 20.). If we use, for example, the universal quantity of space-time exchange, the velocity, we have to arrest time by assigning it a definite closed number, e.g. 1 as a unit of time, before we can assess space:<sup>76</sup>

$$v = [1d\text{-space-time}] = [1d\text{-space}]f = [1d\text{-space}], \quad \text{when } f = 1 \quad (46-2)$$

As the two constituents are canonically conjugated entities of space-time, which is a unity *per se*, we have to eliminate the dynamic reciprocal character of one of the constituents to assess the other as an *instantaneous* magnitude<sup>77</sup>. The elimination of the reciprocal character of space and time is virtually achieved by assigning the one constituent a fixed *closed* number, preferably the number “1“. Only after this abstract mathematical procedure is performed, can we measure the actual magnitude of the other constituent. This is the notorious **static** view of the physical world, which is a consequence of the use of mathematics as the only method of definition and measurement of physical quantities.

Alternatively, we can regard any wave as a circular motion of particles in a medium. This is a common approach in physics which has produced the *classical wave equation* (chapter 4.5). In this case, physicists do not consider the wave as a distinct entity, but as an incessant repetition of equal vibrations (oscillations). Such events can be counted. Their number, being an actual quantity of time  $f$ , assesses energy exchange in a quantitative manner<sup>78</sup>. If there are  $f$  waves with the constant energy of  $E_A$  which propagate through a

---

<sup>76</sup> When Newton and Leibniz first tried to calculate the *instantaneous velocity* of accelerating motion, they were confronted with the opposite problem. In order to measure this one-dimensional quantity of space-time, they had to reduce the magnitude of one constituent - either space or conventional time - to an infinite small value. The result was the famous invention of *differential calculus*. The calculation of *mean velocity* required the integration of all instantaneous velocities - this led to the invention of *integral calculus*. As we see, these mathematical disciplines have their origin in the adequate perception of space-time - in the reciprocity of space and time.

<sup>77</sup> As the reader may convince himself, even the term “instantaneous“ contains the idea of the certain event as „1 instant“ or 1 *unit*. This hidden semantic tautology confirms the ubiquitous presence of the primary axiom in human language.

<sup>78</sup> Although it is generally neglected in wave theory, waves are nothing, but energy interactions. Each wave can be regarded as an energy package or a quant.

point in a medium and trigger a periodical motion of the particles at this point the total kinetic energy of the particles is:  $E = E_A f$ . This is a simple derivation of the Universal Law for any *harmonic oscillation*. We shall show that the *classical wave function* and *Schrödinger wave equation* of quantum mechanics (chapter 7.2) are derivations of the Universal Law. From this point of view, energy exchange is regarded as an interaction of constant packages of energy, which we define as action potentials. Each action potential can be presented as a wave. For this reason, we can assign fixed closed numbers to their constant amounts of energy (see also Bohr's energy quantization model of the hydrogen atom in chapter 7.1). In physics, this is done by comparing the energy of an event with the energy of a reference system, which can arbitrarily be defined as 1 *joule*:  $E_A = 1 \text{ joule}$ . The measurement of energy, e.g. the calculation of energy balance in a system which proves the conservation of energy, is a comparison of the actual energy exchange with a *reference action potential*  $E_A$ , called **1 joule**:

$$f = E / E_A = E / 1 \text{ joule} = n = SP(A) \quad (46-3)$$

By attributing a fixed closed number to a constant amount of energy, we obtain a real closed number for its constituent time. We achieve the same result if we assign space a fixed closed number, e.g. in velocity  $s/t = f = SP(A)$ , when  $s = 1$ .

Here we must stress that there is no way of measuring *directly* space-time - we can only measure its constituents in a separate way (see footnote 69). The method of measurement of the two constituents as distinct entities pre-determines the traditional **dualistic** view of nature, which discriminates between *static* space and *dynamic* time, the latter, although a number, regarded as a variable of the incessant energy exchange. Although energy exchange is generally associated with motion, physics can only assess energy exchange in a quantitative manner as numbers,  $n \text{ joules}$ . This dichotomy in the *weltanschauung* has its origin in the European scientific tradition, which goes back to the Milesian school (e.g. Heraclitus fire or flux, as a synonym for dynamic space-time) and to the Pythagoreans, who regarded geometry and numbers as the origin of any knowledge upon the world. The dualistic outlook, in its profane version, comprehends nature simultaneously as *matter (substance)*, which can be described as geometric space and an everchanging energy, which is considered to be a kind of a structure-less, space-less fluid<sup>79</sup>. This schizoid, unreflective picture of the world has produced a number of paradigms which are basic to modern physics: 1) atoms versus the void (Thracian atomists) 2) substance versus energy, e.g. Spinoza's *natura naturata* versus *natura naturans* 3) particles versus waves, e.g. *de Broglie's* wave-particle dualism. But also in religious and everyday matters, space-energy dualism of ancient Greeks - Pythagorean geometry of statics versus Heraclitus flux of

---

<sup>79</sup> This view is basic to thermodynamics and electromagnetism.

dynamics - is the intellectual substrate behind every popular dualistic prejudice, such as soul versus body, spirit versus flesh, chaos versus order, which can be found both in genesis and science. The list is infinite. Most of the confusion in European philosophy, science and, last but not least, in religion has emerged as a result of this intellectual dichotomy<sup>80</sup>. We conclude:

The **universal equation of energy**  $E = SP(A)[2d\text{-space-time}]$  and the **equation of structural complexity**  $K_s = SP(A)[2d\text{-space}]$  embrace the fundamental *dualism* in human thinking and formalize it in an axiomatic way within mathematics.

The introduction of the new term  $K_s$  effects a great simplification in physics. We shall show that the equation of  $K_s$  is the universal equation of physical geometry when the axiom of reducibility is applied to 3d-Euclidean space. Any structural complexity of physical forms can be described in terms of this equation. As vast sections of physics are dedicated to the geometric description of physical forms as **area**, e.g. as area integrals, the equation  $K_s = SP(A)[2d\text{-space}]$  is frequently used in physical disquisitions. For instance, the fundamental term of electricity, *charge*  $Q$ , is a synonym of structural complexity or area of electric systems and levels. The Schrödinger wave function of quantum mechanics is solved by building area integrals of the elementary particles (see chapter 7.3). The geometric frame behind most physical concepts is, to quote Poincaré, the “hidden definition“ that leads to such metaphysical ideas as “hidden variables“ in *Bohm's* quantum mechanics or “multi-dimensional spaces“ in modern string theories. However, space-time is “termless“:

All terms, which we attach to the external world, come **from** the *mind* and should be first organized **within** the mind. This is the **objective** of the present axiomatics.

**47.** The *continuum* is being (1. & 2.). The whole (being) and its parts (systems and levels) are U-sets. They contain themselves, i.e., space-time, as

---

<sup>80</sup> Even the most prominent philosopher of modern times, B. Russell, is not completely free of this strong dualistic view when he challenges it in his „History of Western Philosophy“: „While physics has been making matter less material, psychology is making mind less mental... I think that both mind and matter are merely convenient ways of grouping events. Some single events, *I should admit*, belong only to material groups, but others belong to both kinds of groups, and are therefore at once mental and material.“, p. 787. In the new axiomatics, there is only space-time and an infinite number of abstract concepts that are U-subsets thereof.  $K_s$  is such a quantity. This eliminates the dualistic view for ever.

an element. The *negation* of being is **non-being**<sup>81</sup>. As we are part of being, we have **no** idea of non-being. Non-being is an N-set: a set which does not contain *itself* as an element, for instance, vacuum contains energetic particles which are not void. The idea of non-being is merely a product of human consciousness, which is a level of being; it reflects the transitory character of human existence as a physical body. This perception of the finite lifetime of the human body is projected onto the whole in an abstract way. Thus the very idea of non-being is of *energetic* character - therefore, it does not contain itself as an element. For this reason, it should be eliminated from science as a false concept. The whole determines the essence of its parts. Therefore:

The only way to acquire knowledge on the parts is to depart from the whole. This is the **epistemological arrow** of the new axiomatics.

All secondary concepts that contain non-being as an element are also N-sets and should be **eliminated** from science. This is a consequence of the elimination of the continuum hypothesis (37.). "Vacuum" is such an N-set: the popular idea in physics is that the *void* contains the elementary particles, the gravitational and electromagnetic fields and all material objects, which are of energetic origin. We realize that the concept of vacuum as a subset of non-being is a *complementary* set of the levels and systems of space-time and is thus not a negation of their existence. Vacuum cannot exist as a separate concept without the simultaneous idea of the **existence** (1) of **being** (1a). The last statement exemplifies the inevitable tautology of the primary term: the existence is being: (1) = (1a). This is the last frontier of human knowledge - for ever!

**48.** The **zero-set** (*von Neumann's set*) belongs to the continuum - it is part of being. The zero-set is not *non-being*. The definition of this set depends on the choice of the complementary sets, of which it is a product. Every zero-set which we build in the physical world is *relative* depending on the choice of the reference system of measurement. As with all other physical quantities, the zero-set can only be defined through the method of definition and measurement (19.).

**49.** All systems of space-time have a **finite** lifetime. This is a consequence of the incessant vertical and horizontal energy exchange (7., 8. & 11.). When we speak of *dissipation* of systems, forms, or structures, we mean energy interaction, in which one system or action potential is transformed into another system or action potential and vice versa (conservation of action potentials).

---

<sup>81</sup> "Non-being" is not a complementary set of "being", as some mathematically orientated readers may believe. At this level of reflection mathematics fails as a concept.

*Explanation:* The dissipation of structures is an intrinsic part of being and a central theme in philosophy and modern science. How to avoid economic collapse, is the key objective of any economic approach, be it *fiscal* (Keynes) or *monetaristic* (Milton Friedman)<sup>82</sup>. All elementary particles have a finite lifetime that can be assessed in terms of statistics, e.g. *mean lifetime* or *half-life*. All forms of organic life, such as individuals, species and evolutions of organic forms of life on planets, have a finite lifetime. This is also true for all gravitational objects - the finite lifetime of stars and the energetic conditions, under which stars evolve from one form into another, are well described (see Chandrasekhar's boundaries).

There are many circumlocutions for the dissipation of forms. Some common terms are: death, catastrophe, singularity, crisis, apoptosis (of cells) etc. The preservation of structural complexity within the social levels of space-time can only be achieved if its self-organisation complies with the Law. This is a major theme in volume IV. The eschatological role of mathematics for the implementation of the Law in shaping society is covered in volume I (chapters 13.7, 13.9 & 13.10).

**50. The Evolution Law:** This law is an *aspect* of the Universal Law. It is not a distinct entity. Human consciousness, being essentially a product of education<sup>83</sup> and trivial prejudices, apprehends space-time as structural complexity

---

<sup>82</sup> The sudden collapse of the communist system, which for a while was very close to achieve a world hegemony, can be explained with the fact that the principles of this experimental socio-economic order infringed upon the Universal Law. This also holds for the so called "free" economic market, which is, in fact, a cartel of inefficient monopolists sponsored by the state at the expense of the consuming population. The systemic neglect of the Universal Law in the capitalist market is thoroughly analysed in a collection of lectures, which I prepared in 1998-1999. There, I have predicted a global economic crisis, which will begin in the spring of 2000 and will ultimately lead to a complete collapse and remodelling of present-day society by the end of 2012.

<sup>83</sup> Scientific education has since antiquity been to a large extent geometric education, which is a *study of forms*. Major philosophic works, with which Modern Times began (Descartes and Spinoza), have been written according to the geometric method. Classical physics is *applied geometry*. Medicine and bio-sciences are purely descriptive systems of organic structures and forms (see vol. III). The dynamic energetic approach to nature, which goes back to Heraclitus, is virtually not represented as a scientific view in modern education. This is the reason why evolution of space-time, with the modest exception of ill-guided *Darwinism*, is not an object of scientific interest. There are many reasons for this intellectual neglect - a major one is the difficulty to present the dynamics of space-time evolution in an adequate didactic form, which will inevitably be static. This is also the fallacy of modern applied mathematics - it operates with *closed* real numbers and has virtually no theory of how open transcendental numbers should be applied to the physical world. However, the continuum of transcendental numbers is the only adequate, mathematical perception

$K_s$  (46.). The primary term, being an incessant energy exchange (8.), has, so far, evaded cognitive and educational perception. This is the reason why the Law was not discovered a long time ago. If we now accept the conventional scientific approach of describing nature in a static way as structural complexity, we assume the traditional view which is opposite to that of the new axiomatics. Since our axiomatics is valid both ways<sup>84</sup>, we can express the universal equation (42-5) in terms of **structural complexity**  $K_s$  (46-1):

$$E = SP(A)[2d\text{-space}]f^2 = K_s f^2 \quad (50-1)$$

If we write this equation for  $K_s$ , we obtain a simple equation:

$$K_s = E t^2 \quad (50-2)$$

The structural complexity of each level or system is proportional to the exchanged energy ( $K_s \approx E$ ) and grows with the square of conventional time  $t^2$ . This equation is called the “**square time law of structural complexity**“ or simply the “**Evolution Law**“.

*Explanation:* Just as we interpret the universal equation as a mathematical envelope of space-time (energy exchange), we can interpret the Evolution Law as a *geometric envelope* of space complexity. This new expression of the Universal Law assesses the static *space*-constituent of energy as it evolves in time<sup>85</sup>. None of the concepts - space, time and energy - are distinct entities. It is

---

of the incessant energy exchange and its dialectical counterpart - the evolution of forms. The KAM-theorem, which assesses the boundary conditions of the universal order and stability, delivers transcendental numbers as solutions to practical problems (see vol. I, chapter 13.9). Unfortunately, this branch of mathematics is without any practical relevance at present. The situation will dramatically change, once the discovery of the Universal Law is realized at the collective level. This will open new incommensurable perspectives for mathematical research and its wide application in empiric science.

<sup>84</sup> We call this property “axiomatic transitiveness“. The virtue of any axiomatic system is that it can be transformed into another axiomatic system. The reason for this transitiveness is their common origin in the primary term.

<sup>85</sup> The economic progress of mankind can be interpreted in terms of growing structural complexity. Each new industrial product contributes to an increase in  $K_s$ . This becomes evident when we compare the variety of products used in the construction of houses today with the few natural products, such as stone and timber, which have been employed in the past. Stone and timber are still the only materials used in many parts of the poor Third World. The consumption of energy  $E$  which is necessary for the production of new building products is proportional to their growing structural complexity:  $K_s: E \approx K_s$ . Industrial production given as  $K_s$  has increased exponentially

the degree of freedom of our mathematical consciousness to discriminate between these terms in an abstract way. As long as we are aware of the fact that space-time is a unity, we can proceed with the mathematical discrimination of its constituents and their combination to various abstract physical quantities, provided that these secondary terms are derived in an axiomatic manner. Before we begin with the practical implementation of the new axiomatics in physics and cosmology, we shall summarize its outstanding epistemological result, which is a recurrent motif of this book:

While the levels and systems of space-time are *real* entities, the **physical quantities**, with which they are described, are **abstract secondary terms**, which are axiomatically derived from the primary term (U-subsets). The method of definition and measurement of these quantities is *mathematics*. The actual magnitudes of these quantities are numerical *space-time relationships*. Theoretical physics is an axiomatic system of physical terms. Experimental physics is an application of the new axiomatics with the objective to **create** new levels of energy exchange, which will solve the energetic problem of mankind. The eschatological endpoint of any scientific endeavour is the *survival* of mankind. However, all local systems have a *finite* life.<sup>86</sup>

---

in the last 100 years, as can be confirmed in the long-term statistics of economic development - hence the relation  $K_s \approx t^2$ . As we see, the dynamics of economic progress can be described in terms of the *Evolution Law*:  $K_s = Et^2$ . Precisely for this reason, the industrial countries that produce the greatest structural complexity of industrial products have the greatest energy consumption and vice versa. There is no exception to the Evolution Law.

<sup>86</sup> Mankind can only achieve immortality if it becomes an active part of the trans-galactic consciousness. Like all levels of space-time, this level is also evenly distributed in the universe. This is the *cosmological principle* as a logical conclusion from the new axiomatics. A prerequisite to enter this trans-galactic club of consciousness is to have a knowledge of the Universal Law and be able to organize society according to it. However, mankind is light-years away from this endpoint. Therefore, the survival of this local system of consciousness is uncertain.

### 3. CLASSICAL MECHANICS

#### 3.1 FORMALISTIC METHODS OF PRESENTATION

Mechanics is a study of dynamics and statics of forces as it is brought to a focus in the three Newton's laws. *Force* is the preferred quantity of energy (space-time) with regard to *linear motion*, while *circular motion* is described in terms of energy (see chapter 3.4). This is the degree of freedom of mathematical consciousness. Mechanics acknowledges *velocity* as the universal manifestation of energy exchange. Most of this discipline is dedicated to the assessment of this physical quantity within the framework of geometric formalism. Motion or velocity is assessed in one, two and three dimensions within Euclidean space, the latter being the universal reference system of definition and measurement of physical quantities in classical mechanics since Newton. These quantities are abstract subsets of the primary term and have no real existence outside mathematical formalism. As previously stated, the only real thing is energy (space-time). For this purpose, real objects (systems) of gravitation are presented as space-less particles of mass called "*mass points*". The change in the position of the particle under observation  $x_2 - x_1$  is called *displacement*  $\Delta x = x_2 - x_1$ ; it is [1d-space]-quantity. The **average velocity** is the rate with which the position changes:

$$v_{av} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{\Delta x}{\Delta t} = [1d - space] \cdot f = [1d - space - time] \quad (1)$$

The average velocity is described as the slope of the straight line connecting the geometric points  $(x_1, t_1)$  and  $(x_2, t_2)$ . However, displacement is seldom (in fact, never) a straight line. This is a voluntary approximation within geometry, just as average velocity is an approximation of instantaneous velocities. We can only compare quantities (relations) if we build equivalences (principle of circular argument) - the straight line of the velocity slope can be divided into equivalent segments, so that the latter can be compared to each other.

The method of definition of instantaneous velocity is *differential calculus* within Euclidean space, or *Minkowski world* (equivalence between mathematics and geometry, Beltrami and Klein). It is defined as the slope of the line tangent to the x-versus-t curve at that time. In differential calculus, the **instantaneous velocity** is the limit of the ratio  $\Delta x/\Delta t$  as  $\Delta t$  approaches zero:

$$v = \lim_{\Delta t \rightarrow 0} \frac{\Delta x}{\Delta t} = \frac{\text{slope} - \text{tangent} - \text{line}}{x - \text{versus} - t - \text{curve}} = \frac{dx}{dt} = [1d - space - time] \quad (2)$$

The limit is called the *derivative* of  $x$  with respect to  $t$ . The epistemology of differential calculus as applied to motion and its quantity, velocity, lies in the intuitively correct notion of the reciprocal character of the two constituents, space and time. This is also the method of solving all mathematical paradoxes of motion since antiquity, as they always imply the infinity of space-time and the reciprocal character of its constituents (e.g. Zenon paradox of Achilles and the turtle). The idea of diminishing conventional time to the infinite small number  $\Delta t \rightarrow 0$  leads to increasing (absolute) time  $f$  that approaches the infinite great number  $\Delta f \rightarrow \infty$ . Infinity can also be expressed with the number “1” or a relation thereof - hence  $\Delta f \rightarrow \infty = 1 = \infty/1$  (principle of last equivalence). By arresting time  $f = \text{cons.}$ , we acquire the space-quantity of a gravitational object in motion as a *constant* static magnitude that is specific for each system of space-time under observation. This is the origin of the static view of classical mechanics, in particular, and physics, in general, as already discussed in the axiomatics. This outlook culminates in *de Broglie's wave-particle dualism* of quantum mechanics (see chapter 7.2).

The constancy of space reflects the constant character of space-time as manifested through its U-subsets, conventionally defined as physical quantities. This property of the primary term is also expressed by another important quantity of classical mechanics - **acceleration**  $a$  or  $g$  for the earth's gravitation that is *constant* for each particular gravitational system. It is derived in the same way as velocity by employing differential calculus. The **average acceleration** is  $a_{\text{av}} = \Delta v / \Delta t$ , while the instantaneous acceleration is the limit of the ratio  $\Delta v / \Delta t$  as  $\Delta t$  approaches zero. The mathematical presentation of **instantaneous acceleration** takes into consideration the two-dimensional expression of space-time within mathematical formalism (see axiom of reducibility):

$$a = \lim_{\Delta t \rightarrow 0} \frac{\Delta v}{\Delta t} = \frac{dv}{dt} = \frac{d(dx/dt)}{dt} = \frac{d^2x}{dt^2} = [1d - \text{space}]f^2 \quad (3)$$

The square of the differential sign  $d^2$  in the numerator indicates the squared time  $f^2$ , which is a consistent result from the two-dimensional presentation of space-time in physics. In principle, it can be substituted by any  $n$ -dimensional presentation (degree of mathematical freedom). Hence, the infinity of differential calculus. This aspect will be discussed in detail in conjunction with *Nabla*- and *Laplace-operators* which are basic mathematical devices for the presentation of electromagnetism (see chapter 6.6).

Classical mechanics is generally preoccupied with the assessment of motion with *constant* acceleration, which is a mathematical quantity of the constant  $E_A$ . We shall show that this quantity is central to Newton's laws. Motion with changing acceleration is approximated to motion with constant acceleration by employing the same differential procedure as described for instantaneous velocity. The solution of motion with constant acceleration

leads to the building of functions with one unknown variable - this can be displacement  $x = x_0 + v_0 t + 1/2 a t^2$ , velocity  $v^2 = v_0^2 + 2a\Delta x$ , or conventional time  $t = 2v_0/a$ . This is pure mathematics applied to the physical world. We have already stressed that the Universal Law  $E = E_A f$  is a function with one unknown variable  $y = ax$  because space-time is closed and the parts are U-subsets that contain themselves as an element. It is always possible to reduce a mathematical function to this simple equation in the real world by selecting a real system as a reference and assigning it the number "1" as 1 *unit* or the *certain event*,  $SP(A) = 1$ .

The opposite operation to differential calculus is *integration*. The transitivity of mathematical systems lies in their common origin of space-time. The primary axiom, *energy = space-time*, is a commutative law. While we obtain velocity and acceleration functions from a given position function in geometric space by differentiation, we are at once confronted with the inverse problem of finding the position function  $x$  given the velocity  $v$  or acceleration  $a$ . To solve this problem of transition from dynamics to statics, the initial time  $t$  is selected as zero. This is a pure convention of mathematics (object of thought) - zero time  $t_0$  is without any physical correlate.

This procedure leads to two wrong assumptions that extend throughout physics. The first assumption is that we are in a position to determine exactly the "**initial conditions**" of gravitational motion as a subset of energy exchange. In reality, the "**initial-value problem**" of classical mechanics is a purely mathematical formalism based on unclear primary terms. The partial solution of this problem has given rise to the conviction that we can always find the position of a particle in space-time uniquely at all other times if we know the forces acting on a particle and the position, and velocity of the particle at some particular time. The latter is set at zero in an *a priori* manner (deterministic approach).

The self-delusion in this respect is more than evident. Firstly, the solution of the initial value-problem takes place within the geometric space of mechanics, which is empty and homogeneous. This abstract space is not equivalent to space-time, which is continuous and discrete. Secondly, all real gravitational objects have volume (space) - they are not spaceless mass points. Thirdly, zero conventional time has no real physical meaning: if  $t = 0$ , then  $f = 1/t = 1/0$ , which is "indefinite" in terms of mathematics. It is no coincidence that this operation is forbidden in mathematics, although no explanation has been given for this rule in terms of knowledge. This formalistic *a priori* decision is based on the intuitively correct notion of the nature of space-time - mathematics is an adequate perception of the primary term. In real terms, time  $f$  will approach the infinite great number  $f = \infty/1$  or the certain event  $f = \infty/\infty = SP(A) = 1$ , when  $t$  approaches zero.

These forms of presentation are mathematical iterations of the primary axiom. They assess the limits of any mathematical or physical knowledge. These very limits have been chosen in classical mechanics to assert that the initial-value problem of gravitational interactions can be exactly solved, while this

task is not possible in the microcosm of quantum mechanics, as embodied in the **Heisenberg uncertainty principle**. This is the most preposterous presumption ever stated in physics - since all U-subsets of space-time are open, this would mean that we are in the position to measure exactly all energy interactions in space-time at once. It is a deception born in the realm of mathematical formalism.

This has led to the second essentially wrong assumption in physics, namely, that conventional time is “reversible“. It is generally believed that the initial-value problem can be solved for any time, including time points in the past and in the future. **Reversibility of time** has been correctly regarded as a central paradox in the outlook of modern physics that is apparently contradictory to the notion of space-time evolution, which is an inherent human feeling. A huge bulk of highly confusing literature has been produced on this problem over the years<sup>87</sup>. In the new axiomatics, time is an abstract mathematical U-subset of space-time without any real meaning. This eliminates the problem of time reversibility as an artefact.

There are further objections against the current interpretation of the initial-value problem and the reversibility of time. All systems, including those of gravitation, are open and exchange energy. We shall prove below in a new interpretation of Newton’s law of gravity that gravitational systems exchange energy (mass) with the photon level. This fact indicates that classical mechanics, which only seems to deal with solid objects of matter, cannot be separated from quantum mechanics that deals with photons. In that case, classical mechanics should also be subjected to the Heisenberg uncertainty principle. However, as this principle is not properly understood in present-day physics (see chapter 7.3), it is not considered in the classical interpretation of the initial-value problem and the reversibility of time. This has hindered the integration of classical mechanics and quantum mechanics into a coherent theory of the physical world.

While analysing the initial-value problem, we realize why mathematical formalism is the only method of definition and measurement of physical quantities - the initial position function is presented in physics as *area under the curve*, AUC<sup>88</sup> ([2d-space]-quantity) in a coordinate system consisting of  $v(t)$ -and  $t$ -axis:  $\Delta x \approx \sum v_i \Delta t_i$ . Human mathematical consciousness has the freedom to express any abstract quantity of space-time in geometric dimensions and acquire new quantities, such as 1d-, 2d-, or nd-spaces. In this particular

---

<sup>87</sup> For further reading see P. Coveney & R. Highfield, *The Arrow of Time*, Fawcett Columbine, New York, 1991; I. Prigogine & I. Stengers, *The Paradox of Time*, Piper, München, 1993 and Bergson’s essays on “durée“.

<sup>88</sup> It is important to observe that AUC is a common quantity in pharmacokinetics and in clinical research. Subjective sensations such as pain can be precisely described in terms of AUC (e.g. G. Stankov et al., *Observer- Blind Multicentre Study with Dipyron Versus Tramadol in Postoperative Pain*, *Eur. J. Pain* 16, 1-2, 1995, p. 55-63).

case, time intervals  $\Delta t_i$  are regarded as becoming smaller and smaller, so that their sum equals the AUC, which in its turn equals the displacement ([1d-space]-quantity). Thus integration is an approximation of real transcendental magnitudes of space-time to closed real numbers. Any 1d-space-quantity can also be presented as an equivalent 2d- or nd-quantity (building of geometric equivalences). This is a common method of presenting physical quantities as vectors (see below). The **limit of AUC** is defined as *area integral* and is written as:

$$\Delta x = \lim_{\Delta t_i \rightarrow 0} \sum v_i \Delta t_i = \int_{t_1}^{t_2} v dt = SP(A) \frac{[1d - space - time]}{f} = SP(A) [1d - space]. \quad (4),$$

where SP(A) stands for integration. Each mathematical operation is a meta-physical energy interaction that leads to the building of relationships (principle of circular argument) - hence the use of SP(A) as an equipotent mathematical presentation of the continuum  $n$  (Note: all numbers are relationships). Equation (4) illustrates the tautological use of the principle of last equivalence for the building of mathematical functions or equations. As we can define infinite quantities (variables) of space-time, which are U-subsets of the primary term and abide by the principle of last equivalence (see point 18. in the introduction), there is practically no limit of growing complexity in the mathematical presentation of space-time. The inclination of physicists to explain natural phenomena with a growing complexity of mathematics has been the primordial seduction to which they have been subjected since the dawn of modern physics (see essay on Galilei in chapter 9.9). This has led to the “loss of paradise“ in physics. Only by grasping the simplicity of the primary term, can we explain the bewildering variety of natural phenomena and progress as mankind in space-time and beyond it.

As already mentioned, the two- and three-dimensional presentation of motion in classical mechanics is based on the primary terms of Hilbert’s geometry such as point, called *scalar*, and straight line, called *vector*. The discrimination of abstract physical quantities in scalars and vectors follows a simple rule, which we shall discuss in detail in conjunction with Nabla- and Laplace-operators (see chapter 6.6). However, when analysed in the light of the new axiomatics, this geometric presentation of space-time quantities in classical mechanics appears to be an inconsistent mathematical formalism. It can be summarized in the following **vector-scalar-rule**:

Any quantity expressed in the new [space-time]-formalism that contains velocity as an U-subset, is conventionally defined as vector, e.g. velocity  $v=[1d-space-time]$ , momentum  $p = SP(A)[1d-space-time]$  etc. This also holds for [1d-space]-quantities, while

[2d-space]-quantities are either regarded as scalars, e.g. charge  $Q = K_s = SP(A)[2d-space]$  or vectors, e.g. area as a vector. Time-quantities ( $f$ -quantities), such as temperature  $T=f$  (see chapter 5.1) and frequency  $f = f$ , as well as quantities which are direct relationships of energy (space-time) of the systems, for instance mass  $m = E_x/E_r = SP(A) = K_{x,r}$  (see chapters 3.8, 3.9 & 8.3) are defined as scalars. Energy (space-time)  $E = SP(A)[2d-space-time]$  is also defined as a scalar (static quantity)<sup>89</sup>.

Thus scalars are static quantities that can be expressed as pure numbers in terms of mathematics or points in terms of geometry, while vectors are mainly dynamic quantities of space-time that are expressed as straight lines within the static framework of geometric formalism. At present, neither geometry nor algebra has an adequate method of assessing space-time as a dynamic *recurring* process - therefore physicists resort to a static description of the primary term, for instance, by employing closed real numbers and closed static geometric figures for presenting physical magnitudes. Dynamics of energy exchange can only be expressed with transcendental numbers in an adequate manner. With the discovery of the Universal Law, the principal challenge of modern physics and mathematics will be the appropriate application of transcendental numbers for describing and modulating the real physical world.

*Exercises:*

1. Express the average- and instantaneous-acceleration vector in space-time symbolism.
2. Show that the range of projectile  $R = v_o^2/g\sin 2\Theta$  is a [1d-space]-relationship.

---

<sup>89</sup> Note: The axiomatic definition of absolute time is also a relationship of energy (space-time)  $f = E/E_A$ . It is equivalent to the definition of mass  $m = E_x/E_r = f = E/E_A = SP(A)$ , as  $E_r = E_A$ . This observation is very important for our subsequent discussion of the mass of elementary particles, and how it can be derived from the mass of the basic photon (see chapter 3.9).

### 3.2 NEWTON'S LAWS

„Classical, or newtonian, mechanics is a theory of motion based on the ideas of mass and force and the laws connecting these physical concepts to the kinematic quantities - displacement, velocity, and acceleration.<sup>90c</sup>“

The only “tiny“ problem of classical mechanics is that it is unable to explain these physical concepts and quantities from an epistemological point of view. And this makes the whole difference to the new outlook of our axiomatics. According to the latter, all physical quantities are abstract subsets of the primary term and have no distinct existence in the real world - they are objects of thought created within mathematical formalism. Given the cognitive ignorance of modern physics as regularly expressed by its representatives, one cannot repeat this fact often enough.

In this chapter we shall first discuss the **three laws of Newton** in the light of the new axiomatics and then proceed with the **law of gravity**, which is a derivation of these. We shall show that all laws of newtonian mechanics are applications of the Universal Law. The modern version of Newton's laws is as follows:

**Law 1.** An object continues in its initial state of rest or motion with uniform velocity unless it is acted on by net external force, called the **resultant force**  $F_{net} = \Sigma F$ . This law, also called the **law of inertia**, is a special case of the second newtonian law. It holds true in **inertial reference frames** and cannot discriminate between rest (immobility,  $v = 0$ ) and motion with uniform velocity ( $v = \text{cons.}, a = 0$ ).

**Law 2.** The **acceleration** of an object is inversely proportional to its mass and directly proportional to the net external force acting on it:

$$a = F_{net}/m = SP(A)[1d\text{-space-time}]f/SP(A) = [1d\text{-space-time}]f \quad (5)$$

**Law 3.** Forces always occur in pairs. If object *A* exerts a force on object *B*, an equal but opposite force is exerted by object *B* on object *A* (**actio et reactio**). We shall add to this law: This interaction is independent of whether the objects of matter are in a direct contact or whether they are acting on each other **at a distance**, e.g. through gravitation or electromagnetism. In the latter case, they are connected through the photon level as space-time is continuous and consists of U-subsets.

---

<sup>90</sup> PA Tipler, p. 77

The interpretation of Newton's three laws is fairly simple in the light of the new axiomatics. However, the discussion of the underlying concept of space-time in newtonian mechanics and its further elaboration in Einstein's theory of relativity ought to be much more sophisticated, as it inevitably involves a quasi freudian analysis of the logical fallacies of traditional physicist's thinking. Such a discussion must also include the concepts of electromagnetism, from which modern theory of relativity has evolved. We shall proceed with this issue in section 8., after we have described the classical disciplines of physics in terms of the new axiomatics.

We begin with the novel interpretation of Newton's first law. From the first glance, it becomes evident that this fundamental law of physics cannot discriminate between *rest (immobility)* and *motion with uniform velocity*. This is generally acknowledged, however, without any theoretical consequences. This deficiency of the law is circumvented in traditional physics by the introduction of the concept of **inertia** - hence its name as a *law of inertia*. Inertia, being the aggregated set of the two subsets, rest and motion with uniform velocity, is regarded an intrinsic property of matter - the general belief is that an object stays at rest or moves with constant velocity, if there is no net force acting on it.

This interpretation of the 1. law has grievous consequences for physical cognition. At present, inertia is believed to be an *a priori* property of all material objects in space. For obvious reasons, this property is not attributed to photon space-time, which is regarded an empty homogeneous space (vacuum) in classical mechanics. This view reigns in physics since Newton, although the motion of light with a constant speed was a well known fact since 1676, when *Olaf Römer* first measured it with an astounding precision ( $c = 299,793 \text{ km/s}$ ). This dichotomic view of the physical world as matter (U-set) and vacuum (N-set) has precluded the application of Newton's first law to photon space-time and has thus prevented the understanding of gravitation (see also chapter 4.8).

When we scrutinize the definition of Newton's first law from a formalistic point of view, we easily come to the conclusion that it is only valid when an abstract reference frame is introduced: a reference frame, in which this law holds true, is called an **inertial reference frame**. Such a reference frame should either stay at rest or move with a constant velocity that is equivalent to that of the object under observation. This restriction of the validity of the first law is an obvious tautology (vicious circle): the law of *inertia* is only valid in *inertial* reference frames. For instance, it is not valid when real reference frames are employed, such as the earth or any other gravitational object in space-time because of the small acceleration due to their rotation on the axis, the superimposed revolution around other planets or the sun, the centre of the galaxy, the local group and so on.

As space-time = energy (principle of last equivalence), there is obviously no place in real space-time where no energies or forces are exerted - hence the force  $F$  is never zero, otherwise Newton's second law would be obsolete.

Indeed, there are no real inertial reference systems (frames) in space-time - for instance, all gravitational systems rotate according to the laws of Kepler (see chapter 3.5) and have a centripetal acceleration. Subsequently, the law of inertia is not valid in real space-time, but only in empty Euclidean space (vacuum, N-set) that is imagined to be void of gravitational forces. From this we conclude that Newton's first law is a wrong abstract idea based on N-sets, born in the realm of unanalysed mathematical consciousness. For this reason, the law of inertia is abolished in the new axiomatics. Its epistemological background is extensively discussed in chapters 8.1 & 8.3.

As we see, the inertial reference frame of classical mechanics is an abstract concept without any real meaning. The method of definition is geometry by employing N-sets. The universal inertial reference frame of classical mechanics is the empty Euclidean space which was first introduced by Newton. All subsequent inertial reference frames are defined within this geometric formalism: "Any reference frame that is moving with constant velocity relative to an inertial reference frame is itself an inertial reference frame"<sup>91</sup>. This vicious circle goes back to Newton and biases the whole edifice of classical mechanics in a systemic way. Ironically, it is generally considered to be his greatest achievement. By introducing Euclidean space in physics, Newton intended to free Galilei's presentation of gravitation from its attachment to the earth. He presented the three laws of mechanics, which were first formulated by Kepler, in a generalized form that appeared detached from earth-bound experiments: "In arriving at these laws Newton had to preface the actual mechanical principles by making definite assertions about space and time."<sup>92</sup> These assertions are fundamental to the actual concept of space-time in physics and will be discussed in detail in chapter 8.1. The analysis of Newton's first law leads to the following conclusion:

The *law of inertia* is defined for empty Euclidean space, which is the initial inertial reference frame of classical mechanics. This reference frame is of abstract mathematical character and has no real existence. Since it is based on an N-set (void, vacuum), the concept of Euclidean space and inertial reference systems must be excluded from the new physical axiomatics. Subsequently, the law of inertia is not valid in real space-time and must be also rejected.

We shall show in chapter 8.3 that the partial insight in this fact has triggered the development of Einstein's theory of relativity.

*Newton's second law* assesses gravitational space-time as *force* and *acceleration*. Both quantities are abstract subsets of the primary term. This law is in

---

<sup>91</sup> PA Tipler, p. 80

<sup>92</sup> M. Born, Einstein's theory of relativity, Dover Publications, New York, 1965, p. 55.

fact a **law of gravitational energy** and thus a concrete application of the Universal Law. When the displacement is regarded as 1 *unit* or the certain event:  $\Delta s = SP(A) = 1 = 1 \text{ unit}$ , the equation of energy is written for the force:  $E = F\Delta s = F$ . As this law is valid for any displacement  $\Delta s$ , it should be presented as an energy law. We conclude: Newton's second law is a derivation of the Universal Law for the gravitational level of space-time:

$$E = F\Delta s = SP(A)[2d\text{-space-time}] = SP(A)[1d\text{-space-time}]f = F,$$

when  $\Delta s = 1$  (6)

In fact, when this law is applied to circular motion in the wave theory, it acquires the above presentation (see torque (21)).

*Newton's third law* is an application of the axiom of conservation of action potentials for the quantity force  $F = ma = SP(A)[1d\text{-space-time}]f$ . Alternatively, it can be interpreted as an intuitive perception of the reciprocity of LRCs of contiguous levels. Both axioms and the third law assess the reciprocity of space and time. What is the conventional epistemology of this law?

Our sensation of weight comes from *actio et reactio*, for instance, sitting on a chair we feel the force (energy)  $E_{reactio} = E_{A1}$  exerted by the chair on our body that balances our weight  $E_{weight} = E_{A2}$  and prevents us from falling to the floor  $E_{reactio} = E_{A1} = E_{actio} = E_{A2}$ . The term "weight" ( $F$ ) is thus a circumlocution for the energy exchange between two contiguous material objects<sup>93</sup>. In the condition of weightlessness, e.g. in a free fall,  $E_{weight}$  is completely transformed into the kinetic energy of the falling object in space-time:  $E_{kin} = \frac{1}{2}mv_{max}^2$ . This is the space-time of the photon level when the atmosphere is excluded. Thus any gravitational interaction can be regarded as a product of two interacting action potentials (axiom of reducibility):  $E_{weight} = F\Delta s = E_{A2} = E_{kin} = \frac{1}{2}mv_{max}^2 = E_{A1}$ .

This observation is very important for an understanding of mass (chapter 3.8). If there is no counterforce to balance our weight as in *free fall*, our weight is considered to be zero - this condition is called *weightlessness*. Assigning the number "zero" to this condition is a pure mathematical convention. In fact,  $E_{weight}$  is completely transformed into the kinetic energy  $E_{kin} = \frac{1}{2}m(v_{max})^2$  of the falling object in the space-time of the photon level. Any transformation of an action potential into another can be expressed with

---

<sup>93</sup> It is important to observe that the energy interaction between any two material objects, called "weight", always causes a deformation of the objects, in this particular case, a flattening of the backside. This deformation of the form can be interpreted as a relativistic change of the space-time of the body. This observation is basic to an understanding of relativistic changes in electromagnetism, e.g. the change of the electron form in motion. It led to the introduction of *Lorentz transformations*, which are a prerequisite to Einstein's theory of relativity.

the symbol “zero“ within the framework of mathematics. In this case, the interaction is viewed unilaterally from the position of the action potential that is transformed. As its structural complexity is completely changed into the structural complexity of another action potential, its  $K_s$  at the end of the interaction will be equivalent to the *improbable event*  $SP(A) = 0$  according to Kolmogoroff's theory of probabilities. If the interaction is viewed unilaterally from the position of the emerging action potential, then the latter can be regarded as the *certain event*  $SP(A) = 1$ . It is up to the free will to decide which action potential should be regarded as the occurring event. This is the epistemological background of any statistical test. This formalistic approach of mathematics is extremely popular in the presentation of various conventional derivations of the Universal Law in physics, e.g. Maxwell's equations (chapter 6.13), Schrödinger's wave equation (chapter 7.2) etc. It has also engendered the wrong idea of increasing entropy in thermodynamics (see chapters 5.6 and 5.7).

From this presentation, we come to the first important conclusion in classical mechanics: the three laws of Newton are concrete applications of the Universal Law for gravitational levels or systems.

### Hooke's Law

An important practical application of Newton's laws is **Hooke's law** for *elastic contact forces*. Although it is a well known fact that it is not a distinct law, physics sticks stubbornly to its unreflected tradition of producing various mathematical equations of the Universal Law, which are then regarded as separate laws. This practice obscures immensely the physical theory. Most of the arguments presented in this book are dedicated to this malpractice.

We shall derive Hooke's law from the primary term because this law is basic to our subsequent presentation of the *action potential*  $E_A$  as an *oscillation* (*wave*) in wave theory (see chapter 4.6). In this way, we shall explain why the wave-particle dualism has developed to a mainstream in the physical outlook of nature.

As most energy interactions between gravitational systems that are observed in daily life are contact interactions between material objects, it was felt to be quite practical to express Newton's laws in a new way as to consider *contact forces*. Hooke's law has been derived for *elastic* contact forces exerted by springs, strings and surfaces of objects. If displacement  $\Delta x$  is not too great to allow compression or extension without permanent deformation, that is, if the relativistic change of the space-time of the interacting material objects is *elastic* (*reversible*), then the following relationship is built:  $F_x = (-)k\Delta x$ . The minus-sign is a mathematical convention because  $F_x$  is defined as a **restoring force** and can be discarded from our subsequent elaboration. The constant  $k$  is called the **force constant** - it is specific for each spring. When we solve

Hooke's law for the force constant  $k$  of a spring, we obtain the following equation:

$$k = \frac{F_x}{dx} = \frac{SP(A) [1d - space - time] f}{[1d - space]} = SP(A) f^2 = SP(A) \quad (7)$$

The force constant  $k$  is constant square time  $f = f^n = SP(A)$  of the system, spring, and can be expressed as probability. From the constancy of the primary term we have axiomatically concluded that this is also true for the space-time of any system or level (see introduction). This also applies to the magnitudes of its constituents, space and time. For this reason the (absolute) time of each elastic system is a specific constant. The *force constant* with the dimensionality of squared time is such a natural constant that is obtained within mathematical formalism and can be experimentally verified in the real world (method of definition = method of measurement). It confirms the conclusions of the new axiomatics. Empiricism is always a tautological confirmation of the nature of the primary term as manifested by its parts. Hooke's law is an application of the universal equation for the quantity time within mathematics; this law can also be expressed as an energy law. We leave this exercise to the reader.

Hooke's law is of particular importance for a proper understanding of the new axiomatics. It assesses the elastic behaviour of material objects as a result of the *aggregated* product of indefinite sublevels of *matter* (molecular structures, atoms, thermodynamic level, electrons, nuclei, quarks etc.), which are material U-subsets and participate in the elastic displacement. It can be shown that each of these levels is adequately described by the Universal Law. We shall prove this for Boltzmann's law of the average kinetic energy of molecules in thermodynamics (chapter 5.3) and for Bohr's energy quantization model of the hydrogen atom in quantum mechanics (chapter 7.1). From a didactical point of view, we can ascertain:

**Matter** can be regarded as a paradigm for *continuum* - as the total set of all material U-subsets. As it interacts with photon-level (gravitation, electromagnetism), it also contains photon space-time as an element (see chapter 3.9).

Elastic matter, on its part, is a basic concept of wave theory, where an *elastic medium* is made responsible for the propagation of waves. From this paradigm of classical mechanics the concept of "elastic ether" was developed for photon space-time (Fresnel). Elastic ether was for a long time the only explanatory principle in electromagnetism from a cognitive and operative point of view (Maxwell, Lorentz). Ether was a synonym for photon space-time before this idea was erroneously refuted a century ago by *Michelson* and *Morley* in a

famous experiment based on false assumptions (see chapter 8.2). This intuitive, partially correct perception of photon space-time was subsequently substituted with the concept of vacuum (N-set). According to this view, gravitation and electromagnetism are propagated as *continuous action at a distance* by the mediation of *fields* that are mathematical abstractions. This concept is a classical paradox of human thinking. In our discussion of the space-time ideas in physics in section 8., we shall work out the wrong assertions that have led to the rejection of the concept of elastic ether. These false ideas are intrinsically linked to the concept of inertia in Newton's first law.

From this elaboration it becomes evident that the new axiomatics is instrumental in establishing logical links between the different disciplines of physics, which we shall promulgate into a unified theory in the present volume. For this purpose we shall prove that Hooke's law, being an application of Newton's three laws, is, in fact, a partial solution of the **General continuum law** that is valid for any elastic medium. The latter is the *differential form* of the universal equation as a **wave equation**. The General continuum law is the origin of the classical wave equation (chapters 4.5 & 6.14) and Schrödinger wave equation of quantum mechanics (chapter 7.2). In this context, we should also recall that Newton's laws of classical mechanics triggered the development of differential calculus by himself and Leibniz. This observation illuminates the fact that physics and mathematics are inextricable systems of consciousness - the former, being at once an application and a validation of the latter, furnishes the missing proof of existence for mathematics. As Newton's law of gravity is a derivation from his three laws (see below), we shall automatically prove that:

*Gravitation* is a **vertical energy exchange** between two *continuous* and *contiguous* levels - **matter** and **photon level** - which are of the same character and abide by the Law (see chapter 4.8).

In this way we shall eliminate the present concept of gravitation as an "action at a distance in vacuum". This will be substantiated by the derivation of many new fundamental constants and applications of the Universal law, all of which can be experimentally verified.

At present, gravitation and electromagnetism are regarded as two distinct fields that propagate in empty space with the speed of light, but do not interact. For this reason gravitation cannot be integrated with the other forces. The cognitive misery of this discontinuous approach of modern physics, assuming the existence of vacuum as an N-set of space-time, is highlighted by Max Born:

„Vibrations without something which vibrates seemed to be unthinkable. On the other hand, the assertion that in empty space there are observable vibrations goes beyond all possible experience. Light or electromagnetic

forces are never observed except in connection with bodies. Empty space free of all matter is no object of observation at all. All that we can ascertain is that an action starts from one material body and arrives at another material body some time later. What occurs in the interval is purely hypothetical, or, more precisely, a matter of suitable assumption. Theorists may use their own judgments to attribute properties to the vacuum, with the one restriction that these serve to correlate changes of material things.<sup>94</sup>

Vacuum is, so to say, the waste basket of physics, where the contradictory concepts of this discipline are conveniently deposited.

### **The General Continuum Law is the Differential Form of the Universal Law**

The *General continuum law* represents the simplest mathematical model of *contiguous* action (action by contact) that is propagated by a *transversal* wave in an elastic medium, e.g. in a string continuum of adjacent particles<sup>95</sup>. The method of definition and measurement of this model is differential calculus. If the restoring force  $F_x$  that arises through the displacement of the first particle would immediately affect the last particle of the continuum string, the action should occur instantaneously, as this may eventually be the case in vacuum. This is the traditional outlook of classical mechanics that has commenced with Newton's law of gravity and has remained invariant to the present day. This intellectual inertia among physicists is quite surprising, considering the fact that Newton himself was fully aware of the inherent paradoxicality of his concept of gravitation<sup>96</sup>.

<sup>94</sup> Einstein's theory of relativity, p. 223.

<sup>95</sup> The mathematical formalism employed in the general continuum law is not only the departing point of numerous *string theories*, which have become very popular in the last years, but also of electrodynamics and Newton's, and Einstein's theory of gravitation.

<sup>96</sup> „The fundamental forces (gravitational, electromagnetic, strong and weak nuclear forces) act between particles that are separated in space. This concept is referred to as **action at a distance**. Newton perceived action at a distance as a flaw in his theory of gravitation, but he avoided giving any other hypothesis. Indeed, in 1692 he wrote the following: „It is inconceivable that inanimate, brute matter should, without the mediation of something else, which is not material, operate upon, and affect other matter without the mutual contact, as it must be if gravitation, in the sense of Epicurus, be essential and inherent in it. And this is one reason why I desired you would not ascribe innate gravity to me. That gravity should be innate, inherent, and essential to matter, so that one body may act upon another at a distance through a *vacuum*, without the mediation of anything else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity that I believe no man who has in philosophical matters a competent faculty of thinking can ever fall into it (In third letter to Benthley, Feb. 25, 1692, R. & J. Dodsley, London, 1756)“.

In the new axiomatics, we define velocity as the universal quantity of energy exchange (primary term). The notion of an instantaneous interaction as assumed in vacuum practically eliminates velocity as a physical quantity: if  $t \rightarrow 0$ , then  $v \rightarrow \infty$ . Velocity, being the universal quantity of energy exchange, is assumed to approach infinity in vacuum. This assumption stands in an apparent contradiction to the finite speed of light. In practice, physicists eliminate the energy (space-time) of the photon level from their thinking and regard the speed of light as a solitary phenomenon without a medium. According to this view, photons are particles that move in empty space with the speed of light (in QED). This view is a consequence of introducing vacuum as an N-set. As vacuum itself cannot be assessed (see Born's remarks above), the discontinuity of space-time that has been artificially introduced by physicists, who, to quote Newton, do not "have a competent faculty of thinking in philosophical matters", could have only been circumvented by introducing the concept of the *field* or *action at a distance* (see footnote 10.). Both terms are abstract concepts of mathematics without any real meaning. In fact, they are paradoxical to the concept of vacuum because it is through the field that gravitation or electromagnetism should be exerted as an energy exchange in empty space, while vacuum itself cannot interact. The absurdity of the present concept of gravitation as a "field in vacuum" should be cogent to everybody.

If we, instead, regard "empty space" as photon level (U-subset of space-time) that is **contiguous** to matter, we can easily solve the problem concerning the propagation of transversal waves, such as electromagnetic waves, in continuum (space-time) by expressing this energy interaction as a differential wave equation of the Universal Law.

Consider now the simple differential equation of *deformation*  $d = u/s$ , where  $u$  is the transverse displacement of the particle and  $s$  the original distance

---

P.A. Tipler, p. 89. Unfortunately, physicists have, since Newton, not shown any competence in philosophical thinking and this has predetermined their inability to explain gravitation, as this is illustrated by Tipler himself in his textbook: "Today, we treat the problem of action at a distance by introducing the concept of a **field**. For example, we can consider the attraction of the earth by the sun in two steps. The sun creates a condition in space that we call the gravitational field. This field produces a force on the earth. The field is thus the intermediate agent (i.e. photon level). Similarly, the earth produces a gravitational field that exerts a force on the sun. If the earth moves to a new position, the field of the earth is changed. This change is not propagated through space instantly but rather with the speed  $c = 3 \times 10^8$  m/s, which is also the speed of light. If we can neglect the time it takes for propagation of the field (but we cannot), we can ignore this intermediary agent and treat the gravitational forces as if they were exerted by the sun and the earth directly on each other." p. 89. Precisely the elimination of the *intermediary agent*, being photon space-time, has precluded the establishment of a consistent theory of gravitation.

between the particles. We can write the *restoring force*  $F_x$  as a function of deformation:

$$F_x = pd = p \frac{u}{s} = p \frac{[1d - space]_1}{[1d - space]_2} = p \frac{f_2}{f_1} = pf \quad (8),$$

where  $p$  is the so called **elastic constant**. Observe that the quotient of two time quantities is also time  $f = f_2/f_1$  (see point 38.). From equation (8), we can obtain the dimensionality of the abstract quantity  $p$  by employing the new space-time symbolism:

$$\begin{aligned} p &= \frac{F_x}{f} = \frac{SP(A) [1d - space - time] f}{f} = \\ &= SP(A) [1d - space - time] = \textit{momentum} \end{aligned} \quad (9)$$

The *elastic constant*  $p$  is a pleonasm of *momentum*, which is one-dimensional space-time quantity of energy (42-2). In this volume, we shall come across many mathematical pleonasms (tautologies) in physics, which can be recognized as such for the first time by employing the new space-time symbolism. The elastic constant  $p$  has a specific constant value for each system because its space-time is also constant. This is a proof for the constancy of the primary term as manifested by the parts (see conservation of momentum in (42-3) and (42-4)). Evidently, the consistency of the new axiomatics can be verified by all known quantities and derivations of classical physics. This is the chief objective of the present volume.

When we apply equation (9) to all particles in a string continuum and transform it accordingly, we obtain a differential equation of the *second* order:

$$\rho b = pc = SP(A) f^2 \quad (9a),$$

where  $\rho$  is called **linear density of mass**  $\rho = SP(A)/[1d-space]$  (47),  $b = (v-v_1)/t$  is the change of velocity to conventional time, i.e., acceleration, and  $c = (d-d_1)/a$  is the change of deformation from point to point;  $a$  is the acceleration of the mass particle. The squared time  $f^2$  indicates the order of differentiation (see Nabla and Laplace-operators). Equation (9a) is an iterative presentation of the force constant in Hooke's law:  $\rho b = p = k = SP(A) f^2$  (7). We shall show in chapter 3.7 that equation (9a) is identical to a novel derivation of the law of gravity, which we call the "**universal equation of gravitation**" (38b). The latter is an application of the Universal law for gravitational systems (see also exercise 2. in chapter 3.7).

The ubiquitous validity of the differential form (9a) of the universal equation, called **General continuum law**, has been anticipated by Max Born, notwithstanding the fact that he still sticks to the vicious idea of “infinite velocity“ in vacuum:

„All laws of *contiguous action* in theoretical physics are of this type... Moreover, precisely similar laws hold in the theory of electric and magnetic events. Finally, the gravitational theory of Einstein has also been brought into such a form. We should remark that the *laws of action at a distance* may be written in a form similar to that of *formulae of contiguous action*... Thus we really have the transmission of a force with infinite velocity, a true action at a distance. Such *laws of pseudocontiguous action* will be met with in the theory of electricity and magnetism, where they have really prepared the way for the true laws of contiguous action.“<sup>97</sup>

This quotation reveals that most laws in present-day physics are fictional “laws of pseudocontiguous action“ which have been defined in an abstract way within mathematics and should be thus substituted by “true laws of contiguous action“, such as the General continuum law. This is a clear pledge of one of the greatest physicists to abolish the idea of vacuum and discontinuity of space-time; it is a recurrent theme of this volume.

*Exercises:*

1. Show that *centripetal acceleration*  $a = v^2/r$  is equivalent to linear acceleration  $a = F/m = [ld\text{-space-time}]f$  by using the new space-time symbolism. Prove the same for *circular velocity*  $v = 2\pi r/T$  with respect to linear velocity  $v = s/t$ .
2. Prove that *force*, *mass* and *acceleration* as defined in Newton’s first and second laws are introduced in a vicious circle and are thus abstract U-subsets of the primary term.

*Solution:* Newton’s first and second laws define force as a subset of gravitational energy. The epistemological explanation of classical mechanics is that force is “an influence on an object that causes the object to change its velocity, that is, to *accelerate*.“ *Mass* is defined as “an intrinsic property of an object that measures its resistance to acceleration.“ This is a circular definition of subsets that neglects the primary term and does not explain the real meaning of these terms. This descriptive definition can be deduced from the primary

---

<sup>97</sup> Einstein’s theory of relativity, p. 113. Indeed, in front of so much insight it is hardly to understand as to why physicists have not discovered the Universal Law earlier than that and have, instead, left this tedious and unthankful job to a physician (although the word „physician“ was initially a synonym for „physicist“).

term and expressed in mathematical symbols:  $m_1/m_R = a_R/a_1 = F_1/F_R = E_1/E_R = E_1/1 = K_{1,R} = SP(A)$ , where  $F_R = E_R = 1$  (see equation (41-2) and chapters 3.8 & 3.9). As we see, force, mass and acceleration are abstract subsets of the primary term - they are introduced as relationships within mathematics. These quantities have no distinct existence in real terms.

3. Confirm that the frequently used equation  $a = F/(w/g)$ , where  $w = \text{gravitational force}$ , is a derivation of equation (41-2) in the introduction. Use this derivation to explain *friction* and *drag forces*.

4. Prove that the integral and analytical solution of Newton's laws (*Euler's method*) are *numerical methods* reflecting the nature of space-time within mathematical formalism.

### 3.3 WORK AND ENERGY IN MECHANICS

Newtonian mechanics has selected *force* as a major quantity of space-time. For this reason *energy* is of secondary importance to this discipline. It is introduced in a circular manner through the anthropocentric concept of *work*: "When work is done by one system on another, energy is transferred between the two systems."<sup>98</sup> This is all we learn about energy from mechanics. The rest are physical equations that express the principle of last equivalence for the parts in a tautological manner. One defines the **work**  $W$  done by a force on an object as the product of the force and the displacement of the point on which the force acts:

$$\begin{aligned} W &= F_x \Delta x = SP(A)[1d\text{-space-time}] f \times [1d\text{-space}] = \\ &= SP(A)[2d\text{-space-time}] = E \end{aligned} \quad (10)$$

Work is regarded as a *scalar*, although it is obtained as a product of two vectors, force  $F_x = A$  and displacement  $\Delta x = B$ :  $W = F_x \Delta x = A \times B$  (*dot product*). Here we come across a basic inconsistency of geometric formalism when applied to physics - points and straight lines are voluntarily ascribed to physical quantities (see also vector-scalar-rule in 3.1). As energy contains velocity  $v^2$ , it should be regarded as a vector. However, it is defined as a scalar. It is precisely this definition of energy as a scalar, that is, as *work*, that has precluded the assessment of the primary term as an interacting, inhomogeneous and continuous entity of motion, from which all secondary terms, such as scalars and vectors, are mathematically derived. Such mathematical

---

<sup>98</sup> PA Tipler, p. 135-136

inconsistencies hinder the development of a unified theory of physics and must be eliminated from a theoretical point of view.

Work is defined through **kinetic energy** by employing velocity as the universal quantity of motion:  $W = E_{kin} = 1/2mv_{max}^2 = mv_{mean}^2 = SP(A)[2d\text{-space-time}]$ . Motion is assessed one-dimensionally as a result of constant forces - the interaction of two motions expressed one-dimensionally as momentum results in two-dimensional kinetic energy (axiom of reducibility). If the work is done by variable forces, it is usually assessed as structural complexity  $K_s = AUC$ , which is a  $[2d\text{-space}]$ -quantity:

$$W = \int_{x_1}^{x_2} f_x dx = SP(A)[2d\text{-space-time}] = SP(A)[2d\text{-space}] = K_s =$$

$$= \text{area under the } F_x\text{-versus-}x \text{ curve} \quad (11),$$

In this case,  $f = SP(A) = 1$  is regarded as an accomplished static quantity. Work done by variable forces can alternatively be assessed in three dimensions - such presentations take place within geometric formalism and do not enlarge our knowledge on the primary term. However, the intuitive notion of the nature of space-time is embodied in the concept of work and energy in mechanics. It has been correctly observed that part of the energy of a gravitational system is stored as **potential energy** and cannot be transformed into kinetic energy. Under potential energy one understands the **inner energy** of the system (see *input-output model* of energy conservation below):  $dU = (-)F.ds = SP(A)[2d\text{-space-time}]$ . The minus sign is a pure mathematical convention: space-time is termless. Another frequent presentation of potential energy is  $U = 1/2kx^2$ , which is a derivation of Hooke's law (7) for the primary term when applied to elastic medium, e.g. to a string.

In classical mechanics, energy is subdivided into “**conservative**“ and “**dissipative**“ energy or forces. A force is defined conservative if the total work it does on a particle is zero, that is, when the particle moves around any closed path returning to its initial position, or alternatively: the work done by a conservative force on a particle is independent of how the particle moves from one point to another. This traditional definition describes conservative forces in *closed* systems. Conservative force (energy) and closed character of space-time are synonyms - it is evident that this definition of classical mechanics is an intuitively correct notion of the closed character of the primary term (*perpetuum mobile* of the second kind). However, the idea of conservative forces (energy) in closed systems of space-time is wrong, as all systems of space-time are open and exchange energy.

The idea of *dissipative forces* reflects the open character of the levels and systems of space-time. As physics does not depart from the whole to explain the parts, but the other way round, it is not in the position to develop a coherent idea of the behaviour of the whole in conjunction with the parts, which are

U-subsets and contain the whole as an element. Traditional physics has not yet grasped the simple fact that all systems of space-time are **open**, but fulfill the condition of conservation of energy - therefore, they are **conservative** at the same time.

The traditional term „dissipative“ tells us that physics does not know what happens with part of the energy that is transformed during friction and other thermodynamic processes. This problem is solved for the first time in this volume by presenting the novel *Stankov's law of photon thermodynamics* which is an application of the Universal Law (see chapter 5.7). This law proves that any material order is transformed into photonic order and vice versa. At present, physics regards photon space-time as a kind of amorphous energy without any order. Therefore it assumes that any energy exchange from “ordered“ matter into “disordered“ photon space-time must go with a dissipation of energetic order. This has led to the notion of “world entropy“. This idea is expressed in the second law of thermodynamics, the law of entropy, which assumes increasing entropy (dissipation) of the universe. According to this idea, the whole must dissipate in the long run - therefore it is not closed but open. “Open“ and “dissipative“ are used at present as synonyms and applied not only to the parts but also to the whole. We show in this volume that the law of entropy builds an antinomy with the law of conservation of energy, also known as the first law of thermodynamics, and must be refuted as a wrong concept (chapters 5.6).

At this place, it is important to observe that all major ideas in physics have been initially established in classical mechanics and only then further elaborated into separate disciplines. The experience with friction has led to the concept of dissipative forces and this concept was further developed to world entropy in thermodynamics - conventional physics always begins with local, anthropocentric experience and generalizes it to natural laws. This trivial approach is opposite to the epistemological approach of the present physical and mathematical axiomatics and has been the chief obstacle for integrating physics in the past.

Classical mechanics has produced a vast array of similar ideas around the concept of energy that vitiate the present physical outlook. A major blunder of classical mechanics is the idea of “**equilibrium**“ and “**disequilibrium**“. It can be summarized as follows: (1) „A particle is in equilibrium if the net force acting on it is zero. (2) In stable equilibrium a small displacement results in a restoring force  $F_x$  that accelerates the particle back toward its equilibrium position. (3) In unstable equilibrium a small displacement results in a force that accelerates the particle away from its equilibrium position. (4) In neutral equilibrium a small displacement results in zero force so the particle is again in equilibrium“<sup>99</sup>.

---

<sup>99</sup> PA Tipler, p. 152-153

Ontologically, these descriptive statements are unprecise circumlocutions of Newton's laws. Note: all the erroneous concepts in physics are of non-mathematical character. Statements (1) and (4) are iterations of the first law: if  $F = 0$ , then the object is at rest (1) or moves with a constant velocity (4). However, we have rejected the law of inertia (see above). Statements (2) and (3) are descriptions of *Hooke's law* and its generalized form - the *General continuum law*. As we see, the four statements are superfluous descriptive iterations of well known laws, which are derivations of the Universal Law, and should not be interpreted any further to suit popular beliefs.

The impact of the equilibrium-disequilibrium idea goes beyond physics and viciates the social sciences and trivial thinking. The mechanistic idea that "all systems are striving for equilibrium", while "disequilibrium" is essentially evil, is basic to most political decisions and reactions and has caused a lot of harm to social ethics and behaviour. The full elaboration of this aspect is beyond the scope of the present book (for details see volumes I & IV).

Mechanics also considers **conservation of energy**, which is an aspect of the closed character of space-time. This gives rise to a slight confusion, as this law is actually defined through **heat** in thermodynamics (chapter 5.4). Instead of defining the conservation of energy by the principle of last equivalence, it is defined by the parts (vicious circle). This is a recurrent blunder of conventional physics. The **law of conservation of mechanical energy** confirms the *constant* character of space-time:

$$E = E_{kin} + U = constant \quad (12)$$

In mechanics, there are many mathematical iterations of the primary axiom as expressed in (12), for instance, the so called "*generalized work-energy theorem*". With one exception, we shall not discuss these and leave their elaboration within the new axiomatics to the reader. The **law of conservation of energy** is presented in mechanics in a generalized form that anticipates the input-output model of space-time as developed in the new axiomatics (see chapter 9.9):

$$E_{in} - E_{out} = \Delta E_{sys} \quad (13)$$

From work (as energy), another abstract quantity is defined - the **power P**:

$$P = \frac{dW}{dt} = Fv = Ef = E_A f, \quad \text{when } E = E_A \quad (14)$$

The quantity power is a classical example of the *creative potential* of mathematical consciousness in defining new abstract quantities that are meta-physical U-subsets of the primary term. Although it may seem strange to those readers, who are proud of the power of their car, power does not exist - it is an abstract term of mathematics. The only real thing is energy: each system

has a specific constant amount of energy which can be assessed by the quantity “power“ within mathematics.

The *conservation of momentum* is another central theme in mechanics. We have already presented it in the introduction when the axiom of reducibility was defined (point 42.). Momentum is closely linked to the concept of “*mass particle*“ or “*centre of mass*“. Within geometry the method of definition of this term is integral calculus. The term, centre of mass, is an abstract construction that facilitates the presentation of motion (energy exchange) in a co-ordinate system. The cognitive problems which one encounters when this idea is applied to the real world have been discussed at length above.

This is also true for the concept of “*elastic collision*“ which has been introduced as an abstract closed system with respect to momentum. On the other hand, the idea of “*inelastic collision*“ acknowledges the priority of reality over fiction. It considers the fact that all systems are open and participate in the cosmic energy exchange, e.g. by emitting photons (see chapter 5.5). Collisions can be assessed in one, two, or three dimensions (degree of mathematical freedom).

The tautological character of physics in inventing new physical quantities, which are mathematical pleonasm, is underlined by the **impulse  $I$** . This quantity is defined as the total change in momentum during the time interval  $dt$ :

$$I = \int_{t_i}^{t_f} F dt = \int_{t_i}^{t_f} \frac{dp}{dt} dt = p_f - p_i = \Delta p = SP(A) [1d - space - time]. \quad (15),$$

where the difference  $\Delta$  (measurement) goes in  $SP(A)$ . Impulse is thus a mathematical pleonasm of momentum. These are the essentials of mechanics.

*Exercises:*

1. Show that the formula of the final velocity in a free fall  $v = \sqrt{2gh}$  is a tautological mathematical presentation of [1d-space-time]. Explain from an epistemological point of view why this formula holds without considering the mass of the falling object, although the initial equation  $U = mgh = E_{kin} = 1/2mv^2$  is based on the mass concept.

*Solution:* Mass is an abstract subset of space-time without any real meaning and can be eliminated within mathematical formalism when the space-time of a system is compared with itself. In this case, the potential energy  $U$  of the falling object is set equivalent to its kinetic energy  $E_{kin}$  at the end of the free fall (axiom of conservation of action potentials):  $U/E_{kin} = LRC/E_{kin} = SP(A) = 1$  and  $m_{pot}/m_{kin} = SP(A) = 1$ . From this, it follows that  $gh = 1/2 \times v^2 = v_{mean}^2 = LRC = [2d-space-time]$ .

2. Confirm that the constant  $k$  in the equation of potential energy  $U = 1/2kx^2$  is identical to the *force constant* in Hooke's law.
3. Derive the *generalized work-energy theorem* from the primary term.
4. Prove that integrating the centre of mass  $MR_{cm} = \int r dm$  is equivalent to measuring the mean value of [*1d-space*]. Explain this procedure with the new definition of level of space-time as a set of equivalent systems (action potentials). Discuss the basic paradigm "motion of the centre-of-mass of a system" and "centre-of-mass reference frame" in terms of the new axiomatics.

*Suggestion:* Begin with the axiom of reducibility.

5. Use the formula of kinetic energy  $E_{kin} = p^2/2m$  to confirm the tautological character of the primary axiom.
6. Express *inelastic collision* in the new space-time symbolism.
7. Describe *jet propulsion*, e.g. the thrust of a rocket  $F_{th} = u_{ex}|dm/dt|$  within the new axiomatics.

### 3.4 SPACE-TIME OF ROTATION

Mechanics departs from linear motion, also called **translation**, which can be without acceleration ( $a = 0$  and  $v = cons.$ ), or accelerated ( $a = cons.$  or  $a = variable$ ). The law of inertia holds in linear motion with no acceleration: when  $F = 0$ , then  $a = 0$ . The second law describes motion with constant acceleration  $F > 0$  and  $a = cons.$ , e.g. in a free fall:  $a = g = cons.$  The free fall approximates linear motion. In reality, any free fall is part of a circular motion when the rotation of the earth on its axis and its revolution around the sun are considered:

**Every real motion in space-time is rotation.** "Circular motion" is a frequent idealization of physical rotation within geometry. Hence the frequent use of  $pi$  in physical formulae<sup>100</sup>. "Linear motion" is an abstraction of rotation when the radius is said to approach infinity  $r \rightarrow \infty$ . Rotation is the universal manifestation of the closed character of space-time through its parts, e.g. gravitational objects and particles.

---

<sup>100</sup> **Note:** The number  $pi$  is an open transcendental number that is used as a closed real number in physics.

The knowledge that every motion of space-time is rotation is central to the new axiomatics. The conventional presentation of rotation reflects this fact. Although the physical quantities describing rotation are very similar to those of linear motion, there are some fundamental mathematical differences that should be worked out. They are important for an understanding of electromagnetism and quantum mechanics, as these disciplines describe rotations.

Rotation introduces a new term, called **angle**  $d\theta$ . It is defined as the *arc length*  $ds_i$  divided by the radius  $r_i$  according to the principle of circular argument:  $d = ds/r_i$ . All real space-quantities are relationships - in this case, the angle is a [1d-space]-quantity. Such relationships are *constant* magnitudes. The angle  $d\theta$  swept across by a radial line in a given time is the same for all particles on the disc. It is therefore called the **angular displacement**  $\Delta\theta$  and is measured accordingly (method of definition = method of measurement):

$$\begin{aligned}\Delta\theta &= \frac{2\pi r_i}{r_i} = \frac{[1d - space]_1}{[1d - space]_2} = SP(A)[1d - space] = \\ &= \frac{f_2}{f_1} = SP(A) = 2\pi rad = 360^\circ = 1rev\end{aligned}\quad (16),$$

where *rad* for radiant and *rev* for revolution are units of angular displacement. These angular units can be obtained from the unit “*degree*” ( $^\circ$ ) by conversion factors which are pure numbers.  $SP(A)$  stands for the difference  $\Delta$  (measurement). However, when  $SP(A) = 1$ , this symbol may not be expressed. In this case,  $\Delta\theta$  is [1d-space]. We shall come across this axiomatic procedure quite often. The angle is a [1d-space]-quantity which is usually presented as a pure number belonging to  $n$  or  $SP(A)$ . This inconsistent approach can be observed in the presentation of other quantities of rotation. It is a major pitfall in physics.

The rate of change of the angle with respect to  $t$  is called **angular velocity**:

$$\omega = d\theta/dt = [1d-space-time] = v \quad (17)$$

Angular velocity is often expressed as reciprocal conventional time  $1/t = f$ , thus leading to cognitive flaws. The **angular acceleration**  $\alpha$  is equivalent to linear acceleration  $a$  (3):

$$\alpha = \frac{d\omega}{dt} = \frac{d^2\theta}{dt^2} = [1d - space - time]f = [1d - space]f^2 \quad (18)$$

Equation (18) confirms the consistency of the new axiomatic approach  $d^2 = 1/t^2 = f^2$ . Differential calculus is transitive to geometry in expressing the primary term: the number of dimensions corresponds to the order of

differentiation. Angular acceleration is usually given as a square time  $f^2 = 1/t^2$ . This shows that geometry is inconsistently applied in mechanics (see also Einstein's cosmological constant in exercise 2., chapter 3.7). Such inconsistencies hinder the development of a true axiomatics. From the angular velocity, the **tangential velocity**  $v_{it}$  can be easily obtained:

$$v_{it} = r_i \omega = \frac{ds_i}{dt} = \frac{r_i d\theta}{dt} = SP(A) [1d - space] \times [1d - space - time] = E_A \quad (19)$$

SP(A) stands for differentiation, which is a measurement (metaphysical energy interaction). In the new axiomatics, the tangential velocity is an **action potential of rotation**  $E_{Arot}$ . However, in conventional physics it is comprehended as velocity. This also causes serious cognitive problems. From the tangential velocity, we can define the **centripetal acceleration**  $a_{ic}$ :

$$a_{ic} = \frac{v_{it}^2}{r_i} = \frac{(r_i \omega)^2}{r_i} = r_i \omega^2 = SP(A) [2d - space - time] \times [1d - space] = \\ = Es = E_{Av} \quad (20)$$

The dimensionality of the centripetal acceleration is identical to that of the *electric flux*  $\phi$  in *Gauss's law* (see chapter 6.12). The reason for this is that electromagnetic waves are transversal waves, which can be regarded as products of rotations (see also wave theory in section 4.)<sup>101</sup>.

When the primary term is applied to rotation, it is known as **torque**  $\tau_i$ . This quantity is defined as the product of a *force*  $F_i$  and the axis of the rotation, called *lever arm*  $l$ , which it exerts on an object. This [1d-space]-quantity is usually expressed as a position vector  $r_i$  with respect to the angle  $\varphi$ :  $l = r_i \sin \varphi$ .

---

<sup>101</sup> It can be shown that electromagnetic waves, which in the new axiomatics are a synonym for photon level, are, indeed, a product of the rotation of gravitational systems, such as *white dwarfs*, *neutron stars* and *black holes* (chapter 9.9, equations (267) and (268)). Basic constants of electromagnetism, such as *permeability* and *permittivity of free space*,  $\mu_0$  and  $\epsilon_0$ , contain constant space and time magnitudes of the photon level that have been derived for the first time by employing the space-time symbolism of the new axiomatics (chapter 6.3). It has been proven that these magnitudes correlate exactly with the space (volume) of the aforementioned gravitational systems, as measured by the *Schwarzschild radius* of stars or by the *event horizon* of black holes, and with the mean rates of rotation (time) of these systems, as they are estimated in astrophysics today. This is the ultimate cosmological proof of the new axiomatics which empirically confirms the *closed energy exchange* between matter and photon level. It shows that space-time is an interrelated entity, so that all fundamental constants can be derived from each other (see the integration of fundamental natural constants in Table 1).

$$\begin{aligned}\tau_i &= F_i l = F_i r_i \sin \varphi = SP(A)[1d\text{-space-time}] f [1d\text{-space}] = \\ &= SP(A)[2d\text{-space-time}] = E\end{aligned}\quad (21)$$

The derivation of the torque is a concrete application of Newton's second law for circular motion and leads directly to the universal equation. Once the energy of rotation is defined, the classical abstract quantity, mass (space-time relationship), can be introduced (see also chapters 3.8 & 3.9). Its method of definition and measurement is mathematics - classical mechanics employs the same procedure as that used to obtain the *centre-of-mass*  $MR_{\text{cm}}$  of objects as a vector  $Mr_{\text{cm}} = \sum m_i r_i$ . In the case of rotation, mechanics resorts to its degree of mathematical freedom and defines mass not as a *linear quantity* (see density in (47)), but as an *area* - e.g. as mass (energy) distributed on a disc area. This hidden definition departs from the angular acceleration and obtains force  $F_{it} = m_i r_i \alpha$  and torque  $\tau_i = m_i r_i^2 \alpha$  as a function of this quantity. The product  $m_i r_i^2$  is defined in a tautological manner as the **moment of inertia**  $I$ . It is equivalent to the new universal space-quantity, *structural complexity*  $K_s = SP(A)[2d\text{-space}]$  as defined in point 46., to which the quantity "mass" is ontologically ascribed:  $m = SP(A) \Rightarrow K_s$ , when  $[2d\text{-space}] = 1$ :

$$I = \sum m_i r_i^2 = SP(A)[2d\text{-space}] = K_s \quad (22)$$

The moment of inertia  $I$  is a physical quantity of space-time defined within mathematics and represents the static view of the world.  $K_s$  can be expressed as  $SP(A)$ , when  $[2d\text{-space}] = SP(A) = 1$  is defined as the certain event or a mass point. When we set  $K_s = SP(A) = m$ , we get for the torque the dimensionality of force  $\tau_i = I \alpha = SP(A)[1d\text{-space-time}] f = F$ . This example illuminates why one often speaks of forces in physics, but always means energy (space-time).

For example, the idea of the four fundamental forces (gravitation, electromagnetism, strong (hadronic) and weak nuclear forces), as put forward in the standard model, reflects the inhomogeneity of energy, of which force is an abstract U-subset. The term "forces" stands for levels of space-time - however, these are infinite. For instance, the standard model does not consider *heat* (thermodynamic level) as a distinct force, although two basic laws (the law of conservation of energy and the law of entropy) and a number of other laws (the ideal-gas law, Boltzmann's law) have been derived for this level of matter. It also neglects the ample fact that most of the engines used in daily life are based on heat. This example illustrates the reductionist approach of the standard model that is considered to be the ultimate intellectual achievement in modern physics. It is, indeed, amazing to witness the eagerness, with which apparently wrong and contradictory ideas are uncritically accepted in physics, and the numerous difficulties which correct ideas encounter before

they are finally adopted by the physical community. In this respect physics is very similar to theology.

From the torque, further pleonasms of rotational space-time are introduced. One of them is **rotational work**:

$$dW_i = \tau_i d\theta = E_A f \quad (23),$$

where  $\tau_i = E = E_A$ , when  $f = 1$  (degree of mathematical freedom), while the angle  $d\theta = SP(A) = f$  can be expressed as time, that is, as a pure number (see equation (16) and point 38.). From equation (23), the quantities *power* and *rotational kinetic energy* are derived.

Another basic quantity of rotational mechanics is the **angular momentum  $L$**  that is broadly used in electromagnetism and in quantum mechanics ( $\omega = f$ ):

$$L = mvr = mr^2 \omega = I\omega = SP(A)[1d\text{-space-time}][1d\text{-space}] = E_A \quad (24)$$

Angular momentum is **rotational action potential**. According to the new axiomatics, it is a constant amount of space-time. Rotational mechanics establishes exactly this result. By applying Newton's second law to rotations, it iterates the law of conservation of momentum defined for the linear motion now for the torque:  $\tau_i = dL/dt = E = E_A f$ . The net external torque acting on a system equals the rate of change of the angular momentum of the system. Alternatively: if the net external torque acting on a system is zero, the total angular momentum of the system is constant (axiom of conservation of action potentials). One always assesses the primary term in the pluripotent variety of physical phenomenon - empiricism is but a tautology of the Law. So do the exercises below.

*Exercises:*

1. Derive the *rotational kinetic energy* and *power* from the primary term. Use these quantities to describe the space-time of rolling objects with various form.
2. Express the *parallel-axis theorem* and the *perpendicular-axis theorem* in the new space-time symbolism.
3. Explain *Archimedes' law* of the lever  $m_1 l_1 = m_2 l_2$  with the reciprocity of energy and space.

*Solution:*  $m_1/m_2 = E_1/E_2 = l_2/l_1$  (see point 41.)

### 3.5 KEPLER'S LAWS

**Kepler's laws** are concrete applications of the Universal Law for gravitational rotation. They are geometric solutions of empirical data collected by *Ticho Brahe*, who was the official astronomer in Prague at that time. Kepler discovered after much trial and error that the actual paths of the planets around the sun are ellipses. His laws are geometric solutions of empirical data and are thus intuitive perceptions of the Law. This is a typical example of physics and cosmology as experimental sciences that always assess the primary term for particular questions. Newton's law of gravity is, instead, a generalized mathematical derivation of Kepler's laws. Newton's major achievements in physics are not of experimental character - it is a historical irony that in his name empirical research has emerged as a main preoccupation of this discipline.

Kepler's laws say: **Law 1:** All planets move in elliptical orbits with the sun at one focus. **Law 2:** A line joining any planet to the sun sweeps across equal areas in equal times. **Law 3:** The square of the period of any planet is proportional to the cube of the planet's mean distance from the sun.

The first law recognizes that real rotations are never ideal circular motion. The "*n-body problem*" of gravitational orbits (Lagrange, Poincaré) reveals that there is no closed solution of gravitation for more than two bodies (three-body-problem). As all systems of space-time are open and exchange energy, we have in reality an *n-body problem*, where  $n \rightarrow \infty$  symbolizes the continuum. The actual orbit of a gravitational body is an *oscillating* path around "libration points", which cannot be periodically solved, although partial solutions have been proposed by different authors. The KAM-theorem developed as a generalized solution to motion in space-time produces "open" transcendental numbers for partial solutions of the *n-body problem* (see volume I).

Kepler's first and second law depart from the definition of angular momentum as a rotational action potential:  $L = mvr = E_{Arot} (24)$ . If one considers the mean distance  $r$  of the planet from the sun, as is done in the third law, it transpires that this [*1d-space*]-quantity is constant for each planet (constant space-time of systems, see points 22. & 33.). The statement of Kepler's second law that the radial line sweeps across equal distances in equal times is an iteration of our axiomatic conclusion on the constancy of space and time for the parts. In this case, the constancy of space-time is assessed as structural complexity that is, as area: [*2d-space*]-quantity. This law is an application of the principle of circular argument. We can build an equivalence by assigning the number 1 to any distance, area, or time interval of gravitational rotation as a unit or the certain event and compare these reference quantities with any other voluntarily selected distance, area, or time of rotation (see also the example with the clock in the introduction, with the help of which we have

explained the primary term of the theory of probabilities, the probability set, in real terms).

From the *rotational action potential* of the planet, one can easily obtain the structural complexity of this gravitational system:

$$L = mvr = E_{Arot} = SP(A)[2d\text{-space}]f = SP(A)[2d\text{-space}] = K_s, \quad \text{when } f = 1 \quad (25)$$

Here we encounter again the classical dichotomy in the physical outlook of nature as dynamic energy and static geometric structure at the same time. In physics, one can only measure geometric structures, hence the reduction of space-time to the geometry of space. Energy can only be counted, for instance, as  $n$  [joules], where the unit of space-time, 1 *joule*, is an action potential, 1  $E_A$  (see thermodynamics, chapter 5.4). It is a constant amount of energy (building of equivalence) that has been voluntarily selected as a reference unit for comparing the space-time of other systems (building of relationships according to the principle of circular argument).

The approximation of elliptical orbits to circular motion is the method of definition and measurement of Kepler's third law  $T^2 = Cr^3$  for the planet's **period**  $T$  of revolution. As space-time - in this particular case, we are dealing with gravitational space-time - has only two constituents, space and time, one can only assess these two quantities. While Kepler's second law deals with the mean area of rotation as a quantity of space, his third law solves for the time  $f = 1/T$  of the planet's rotation.  $C$  is a **specific constant** that has the same value for all planets around a sun. Its magnitude depends exclusively on the space-time of the sun, which determines the gravitational properties of the solar system, while the effects of the planets can be neglected.

When Kepler's third law is obtained from Newton's law of gravity

$$T^2 = \frac{4\pi^2}{GM_s} r^3, \text{ we acquire for the constant } C:$$

$$C = \frac{4\pi^2}{GM_s} = \frac{SP(A)}{F} = \frac{SP(A)}{SP(A)[1d\text{-space-time}]f} = \frac{1}{\alpha} \quad (26),$$

where  $G$  is the **universal gravitational constant** and  $M_s$  is the mass of the sun.  $F$  is the gravitational force which the sun exerts on the planet to induce its revolution. According to the axiom of reducibility, this force results from the interaction between the two entities. The *universal gravitation* is given as  $G$  (29) and the gravitational space-time of the sun as  $M_s$ . We obtain Newton's second law, which tells us that the gravitational force is constant for each solar system:  $F = GM_s = SP(A)[1d\text{-space-time}]f$ . The constant  $C$  is *recipro-*

*cal angular acceleration* (18). The full elaboration of equation (26) will be performed in the next chapter, where we shall first determine the dimensionality of the universal gravitational constant  $G$  in conjunction with Newton's law of gravity and then explain its ontology from consciousness.

### 3.6 NEWTON'S LAW OF GRAVITY IS A DERIVATION OF THE UNIVERSAL EQUATION (ND)<sup>102</sup>

Newton derived his famous **law of gravity** from Kepler's laws. We shall follow Newton's honourable tradition and derive his law of gravity from the Universal Law. The law of gravity is a derivation of Newton's second law within mathematics. Both laws describe gravitational space-time with the quantity *force*, which is an abstract U-subset of the primary term:

$$g = \frac{F_g}{m} = \frac{GM}{r^2} = [1d - space - time]f \quad (27)$$

In this equation,  $M$  is the mass of any particular gravitational system. This quantity is an abstract U-subset of space-time - it is obtained by building a relationship between the space-time of a reference system,  $1kg$ , and the space-time of a system under observation (see method of definition and measurement of mass in point 41. and chapters 3.8 & 3.9). As Newton's law claims universal validity, we can choose any system of space-time, including space-time itself, and set its hypothetical gravitational mass  $M$  in the above equation. According to the *cosmological principle*, which is an application of the principle of circular argument, mass (energy) is evenly distributed in the universe. This is a pure mathematical approximation to the mean value. In reality, there are clusters of galaxies separated by large photon spaces with no visible gravitational mass.

Space-time can be described by Einstein's equation of photon energy  $E = mc^2 = SP(A)[2d-space-time]$ . We have shown that this equation is an application of the Universal Law within geometric formalism when the axiom of reducibility is applied to the quantity "momentum" (see point 43.). For this reason energy is presented as two-dimensional space-time. We can now write for the **mass of space-time**:  $M = E/c^2 = E/LRC_p = SP(A)^{103}$ . Space-time (the

---

<sup>102</sup> From now on, whenever we present a **new derivation** that is not known in physics, we shall use the abbreviation (ND) in the title to draw the attention of the reader.

<sup>103</sup> This relationship is frequently used in physics, but it can only be explained after the new axiomatics has been developed. My experience is that most physicists have psychological problems to accept the reciprocal character of space and time as a cog-

universe) has an extent which we define as *infinite*. By applying the principle of last equivalence, we can set the symbol “1” for its [1d-space]-quantity, e.g. for its diameter  $r = 1$ . All actual space-quotients which we obtain in space-time are thus smaller than “1” and belong to the probability set SP(A). If we set “1” for  $r$  in the denominator of the right term  $GM/r^2$  in (27), we obtain the product  $GM$ . We can express  $M$  by Einstein’s equation  $M = E/c^2$  and obtain a new derivation of equation (27):

$$GM/r^2 = GM = GE/c^2 \quad (27a)$$

We now consider the left side of the equation (27), which gives the *gravitational acceleration* of the earth  $g = F_g/m$ . When we rewrite this equation for the primary term, we obtain the **universal gravitational acceleration  $g_U$** :

$$g_U = F_U/M = [1d-space-time]f = [1d-space]f^2 \quad (27b)$$

In electromagnetism, we shall prove that the *electric field* of photon level  $E_o$  (107) is of the same dimensionality as  $g_U$  (35). As gravitation is exerted at a distance through photon space-time with the speed of  $c$ , we may also speak of “*universal gravitational field*”  $E_G$ <sup>104</sup>. Another common quantity of photon space-time is the **universal potential  $LRC_U = c^2 = [2d-space-time]_p$**  - it is the LRC of the photon level (see point 43.). According to the cosmological principle, we can regard gravitational space-time as the aggregated mean product (U-set) of all particular gravitational fields or potentials in the universe, such as the gravitational potentials of our sun and the earth. The number of all gravitational systems in space-time (the universe) is infinite. As the space-time of any system or level is constant, the universal gravitational acceleration of photon space-time should be constant too - it is an U-subset that exhibits the properties of the whole. The speed of light  $c$  is the universal quantity of photon space-time when it is regarded as motion or energy exchange. It is a fundamental natural constant. We can therefore set  $c$  for [1d-space-time] in the formula of  $g_U$  (27b) and obtain the Law for *one-dimensional photon space-time* (principle of similarity):

---

nitive principle of physics and therefore cannot correctly interpret the quotient  $E/c^2$ . This has hindered an understanding of the theory of relativity.

<sup>104</sup> Although the two quantities, *electric field* and *gravitational field*, appertain to photon space-time, they are different magnitudes built within mathematics. At the same time, they are abstract U-subsets with no distinct existence. Same is true for electric and magnetic fields in electromagnetism. Such sets contain themselves as an element - the element being space-time - and cannot be separated in real terms (see also definition and measurement of the two constituents, space and time). Our consciousness is in the position to define infinite subsets of space-time as systems or levels - hence its infinity in real and metaphysical terms. This crucial epistemological result of the new axiomatics makes the greatest difficulty to conventionally thinking physicists.

$$g_U = cf = [1d\text{-space-time}]f = E_A f \quad (27c)$$

We do not know the value of time  $f$  in this equation. As space-time is infinite, all levels, such as the photon level, have the power of the continuum and are also infinite. Therefore, the time  $f$  must approach infinity, that is, space-time is eternal. This is the utmost limit of any knowledge as embodied by the primary term.

If we now set the terms,  $GE/c^2$  of (27a) and  $cf$  of (27c), in Newton's law of gravity as presented in equation (27) and solve it for the **energy (space-time)  $E$** , we obtain a **novel derivation (ND)** of this famous law:

$$E = \frac{c^3}{G} f = E_{AU} f \quad (28)$$

We conclude:

**Newton's law of gravity** is a derivation of the Universal Law. Equation (28) holds for the *gravitational level* of space-time. The quotient  $E_{AU} = c^3/G$  is called the **universal action potential  $E_{AU}$** . It is a new fundamental cosmological constant that can be experimentally verified.

The gravitational level is per definition an U-subset of photon level - equation (28) contains only quantities of photon space-time,  $c$  and  $G$ , as time can be set „1“.  $E_{AU}$  is constant because it is a quotient of two natural constants,  $c$  and  $G$ . If we express the universal action potential in equation (28) in the new space-time symbolism  $E_{AU} = SP(A)[2d\text{-space}]f$ , we obtain for the **universal gravitational constant  $G$**  the following dimensionality:

$$\begin{aligned} G &= \frac{c^3}{E_{AU}} = \frac{[3d - \text{space} - \text{time}]}{SP(A)[2d - \text{space}]f} = \frac{1}{SP(A)}[1d - \text{space} - \text{time}]f = \\ &= [1d - \text{space} - \text{time}]f = g_U, \text{ when } SP(A) = 1 \end{aligned} \quad (29)$$

The **universal gravitational constant  $G$**  in *Newton's law of gravity* is a physical quantity that is equivalent to the **gravitational acceleration  $g_U$**  or *field*  $E_G$  of the photon level  $G = g_U = E_G$ . It is an abstract quantity of photon space-time which is built within mathematics.

All constants are U-subsets of the primary term - this is a leitmotif of the present volume. The gravitational constant  $G$  can be experimentally measured in a

free fall exerted by the earth's gravitation  $g$  when the classical law of gravity is applied:

$$G = \frac{F_g r^2}{m_1 m_2} = \frac{F_g r^2}{m} = \frac{SP(A)[1d - space - time]f[2d - space]}{SP(A)[2d - space]} f =$$

$$= [1d - space - time] = g_U \quad (29a),$$

where  $m_1 m_2 = m = SP(A)[2d - space] = K_s$ . The fact that a simple local experiment renders the universal quantities (magnitudes) of photon space-time proves the closed, interrelated character of space-time. We do not need to perform expensive experiments in astrophysics to gain information on the universe. The derivation of  $E_{AU}$  proves that we can obtain all useful information on the universe from known natural constants that can be exactly measured in simple experiments (see Table 1). This is a major conclusion of the new theory. It goes without saying, that this insight will revolutionize physical and scientific research. For example, we shall derive below the age and radius of the (visible) universe from the new derivation (28) of Newton's law of gravity. At present, these magnitudes are estimated with great difficulties from redshift-distance relations observed for selected galaxies by employing Hubble's law, which is another application of the Universal Law (see chapter 9.2).

The **universal action potential**  $E_{AU}$  of the vertical energy exchange between matter and photon level has the following magnitude when expressed in SI units:

$$E_{AU} = \frac{c^3}{G} = \frac{(2.9979246 \times 10^8)^3 [ms^{-1}]^3}{6.6726 \times 10^{-11} [m^3 kg^{-1} s^{-2}]} = 4.038 \times 10^{35} [kgs^{-1}]. \quad (30)$$

We conclude:

The **universal action potential**  $E_{AU} = c^3/G$  assesses the *vertical energy exchange* between the *photon level* and the *gravitational level*, also defined as "matter". Both levels are U-subsets of space-time that contain themselves as an element and cannot be separated in real terms. Each second the gravitational mass of the magnitude of  $4.038 \times 10^{35} \text{ kg}$  is exchanged between the two levels. The **gravitation** between material objects, defined as horizontal energy exchange of *attraction*, is exerted through this vertical energy exchange (U-sets).

The consistency of the new axiomatics is confirmed by equation (30). We attribute mass ontologically to  $K_s = SP(A)[2d\text{-space}]$ , as  $f = 1$ . When the space of a system is regarded as the certain event  $[2d\text{-space}] = SP(A) = 1$ , that is, as a centre of mass, we can also write  $m = K_s = SP(A)$ . As the method of definition and measurement of mass employs the second procedure  $1kg = K_s = SP(A) = 1$ , we usually find mass in traditional physical equations as an energy relationship, to which the symbol  $SP(A)$  can be attributed. However, there are some derivations that require the full expression of mass as structural complexity. For instance, the volume of the universal action potential in (30) is approximately equal to that of a galaxy. This volume can hardly be reduced to a spaceless centre of mass, as is done for other gravitational objects in classical mechanics. If we write equation (30) in the new space-time symbolism, we obtain the classical space-time presentation of the action potential as “area in motion“ (see (42-6)):

$$E_{AU} = [kgs^{-1}] = SP(A)[2d\text{-space}]f \quad (30a)$$

Equation (30a) demonstrates that we can express the SI units in the new space-time symbolism and acquire consistent results and vice versa. This *transitiveness* of mathematical expressions is inherent to any axiomatic system, such as mathematics or the new axiomatics, as they have a common origin in the primary term.

The *universal action potential* is an important natural constant that can be easily derived from Newton’s law of gravity when it is expressed in the generalized form of the universal equation. It plays a central role in cosmology. With the help of this quantity we shall refute the standard model and prove that the universe, that is, space-time, does not expand (see section 9.).

### 3.7 THE ONTOLOGY OF NEWTON’S LAW FROM CONSCIOUSNESS - A PARADIGM OF HOW PHYSICAL LAWS ARE INTRODUCED IN PHYSICS (ND)

The new axiomatics is based on the primary term, which is the only real thing. All further terms are abstract concepts of the mind that are derived from space-time in a consistent way within mathematical formalism. This is a recurrent motif of the present book. The new axiomatics is *transitive*, that is, one can depart from any secondary term of abstraction and deduce it from the primary term, which is the origin of all sciences. Transitiveness of mathematics is a result of the closed character of space-time. This property is assessed by the primary axiom, also called the *principle of last equivalence*. As all parts of the whole reflect the nature of energy (space-time), this principle is of universal validity - all definitions of secondary terms, with which physical

phenomena are described, are based on it. In this case, we call it the *principle of circular argument*. The proof of existence of any real axiomatics (recall: pure mathematics is hermeneutic - all mathematical terms are object of thoughts) should be searched in the real physical world. The determination of secondary quantities of space-time, such as mass and charge, for which mathematics is the only *method of definition*, through experiments in the real physical world, where mathematics is the only *method of measurement*, reveals the tautological character of any empirical research. One always assesses the Universal Law in the particular experimental condition. Hence the equivalence between continuum and space-time.

We shall show in this chapter that the new axiomatics of the Universal Law is *transitive*: for example, it is possible to depart from secondary terms of space-time and define Newton's law of gravity in an axiomatic way without performing any experiments (Newton versus Galilei). We have already proved that this law assesses the primary term of our consciousness (28). As the new axiomatics is based on the primary term of our consciousness, this law is actually deduced from the mind - its ontology is human consciousness<sup>105</sup>. Vice versa, it is possible to confirm this deductive law experimentally, for example, by measuring the *universal gravitational constant*  $G$  in a free fall in the earth's gravitation. The latter is a particular system of the gravitational level. The new axiomatics is simultaneously an operational method of definition and measurement of all physical quantities. The axiomatic deduction of Newton's law of gravity from the mind is thus paradigmatic for the definition of most traditional laws in physics, e.g. Coulomb's Law. Thus logical deduction, as embodied by the present axiomatics, and empiricism, as materialized in current scientific research, are two dialectical aspects of the unity of space-time, that is, of being. However, the Universal Law establishes the priority of logic over action in an irrevocable manner.

Consider an energy interaction  $E$  between two macroscopic gravitational objects defined as "*attraction*" according to the *axiom* of reducibility:  $E = m_1 m_2$ . In classical mechanics, such objects are depicted in terms of structural complexity  $K_s$ , that is, as mass points or mass particles,  $m_1$  and  $m_2$ , in geometric space (see chapter 3.1). The symbols  $m_1$  and  $m_2$  have no particular meaning - they stand for the energy (space-time) of the interacting objects and can be substituted by any other symbol. The new axiomatics clearly states that energy exchange can only be assessed if we consider time  $f = E/E_A$ , which is the dynamic constituent of space-time. This follows from the inhomogeneous character of space-time - it manifests itself through action potentials. We have further proved that we can introduce infinite variables to

---

<sup>105</sup> This conclusion should not be interpreted as a pledge for the ideas of anthropomorphism, which preaches complete agnosticism. Human consciousness is part of space-time and abides by the Law. The same is true for the external physical world. The knowledge of the Universal Law is thus an *a priori* idea.

the universal equation without impairing its validity (see point 18.). Therefore we can add the time of the objects,  $f_1$  and  $f_2$ , to equation  $E = m_1 m_2$  without affecting the axiom of equivalence:

$$E = m_1 f_1 m_2 f_2 \quad (31)$$

It is important to observe that equation (31) is “created“ exclusively on the basis of hermeneutic considerations within the new axiomatics and does not contain any experimental knowledge or physical evidence. Time can be assessed by reciprocal conventional time  $f = 1/t$ , which is concrete quantity thereof. Conventional time can only be measured in conjunction with space, that is, as velocity, which is the universal quantity of motion and energy exchange. If  $t = r/v$ , then  $f = v/r$  ( $r =$  distance) as  $f = 1/t$ . We set  $f = v/r$  in equation (31) and obtain:

$$E = m_1 \frac{v_1}{r} . m_2 \frac{v_2}{r} = \frac{m_1 m_2 [2d - space - time]}{[2d - space]} \quad (31a)$$

Observe that equation (31a) is still a product of axiomatic thinking. This equation is now solved for the force  $F = E/s = E/[1d-space]$ , as this quantity is the preferred one in Newton’s law of gravity:

$$F = \frac{[2d - space - time]}{[1d - space]} \times \frac{m_1 m_2}{[2d - space]} \quad (32)$$

We apply this equation to the photon level (see chapter 3.6), which is the mediator of gravitation between material objects as a vertical energy exchange. The term  $[2d-space-time]$  in the numerator is the LRC of the photon level  $LRC = c^2$ . In this case, the  $[1d-space]$ -quantity in the denominator assesses the extent (space) of the photon level as distance. All gravitational objects are, so to say, imbedded in the photon level, which we perceive as universe or cosmos. This level is infinite because it has the power of the continuum. Our knowledge of the universe is restricted to the **visible universe**. The extent of the visible universe can be assessed by its **event horizon** or, alternatively, by its diameter (see Hubble’s law in chapter 9.2). Both quantities are fundamental cosmological constants.

The visible universe is thus an actual system of constant space-time. Its event horizon is defined in cosmology as  $[2d-space]$ -quantity - as a spherical area, at which the maximum escaping velocity of galaxies is equivalent to the speed of light  $v_{esc}=c$ . According to Hubble’s law, the velocity is greater than  $c$  beyond the event horizon of the visible universe, so that the light from the escaping galaxies can no longer reach the observer. This conclusion from

Hubble's law is basic to modern cosmology. In chapter 7.2 we shall show that this law is an application of the Universal Law for the constant system "visible universe" - this cosmological system is defined through this law.

The term "event horizon" is a pleonasm of structural complexity  $K_s$  of the visible universe. It is also used to describe the geometry of black holes. As the space-time of the systems is constant, the extent (space) of the *visible universe*, which is a specific system (U-subset) of space-time, is also constant. The property of the whole is manifested through its parts. This phenomenon is intuitively reflected by the so called "*cosmological principle*" introduced in physics by Mach, Einstein and Milne. It postulates that the universe is the same for any observer, that is, the event horizon of the visible universe is constant for any observer at any place, at any time in the universe. In other words, there are infinite visible universes of constant space and time because we can imagine infinite observers in space-time. This is an important mathematical application of the principle of last equivalence in cosmology (see section 7.).

The  $[1d\text{-space}]$ -quantity in the denominator of equation (32) is therefore the **circumference**  $S_U$  of the event horizon of the visible universe. It is a basic cosmological constant. The second  $[2d\text{-space}]$ -quantity in the denominator assesses the square distance  $r^2$  between any pair of gravitational objects in space-time (axiom of reducibility). We can set the conventional symbols of these quantities in equation (32):

$$F = \frac{c^2}{S_U} \times \frac{m_1 m_2}{r^2} = G \frac{m_1 m_2}{r^2} \quad (32a)$$

and obtain **Newton's law of gravity** from the primary term. This mathematical presentation has been axiomatically deduced from our mathematical consciousness. Although we have introduced for didactic purposes some physical evidence above, it has no impact on the mathematical procedures leading to equation (32a). It is a pure product of geometric thinking when applied to the visible universe. For this equation, we need not even know the magnitude of the speed of light - it is enough to apply the axiomatic conclusion that all levels and systems have a constant space-time that can be assessed by the universal physical quantity, velocity. From equation (32a), we obtain a constant quotient

$$G = c^2/S_U = 6,6726 \times 10^{-11} \text{ ms}^{-2} \quad (33),$$

which can be experimentally determined, e.g. in a free fall. We get as a result the famous **universal gravitational constant G**.

This new derivation from the mind is a remarkable physical result. At present, conventional physics is unable to link the gravitational constant with

other natural constants. For this reason gravitation cannot be integrated with the other three fundamental forces as given in the standard model. In equation (33),  $G$  is a function of the speed of light  $c$  and the constant circumference  $S_U$  of the visible universe, which can be easily calculated from this equation (see below). On the other hand, the speed of light is a composite physical quantity - it is a function of the **permittivity  $\epsilon_0$**  and **permeability  $\mu_0$  of free space** (photon space-time) in the famous **Maxwell's equation of electromagnetism  $c^2 = 1/\epsilon_0\mu_0$**  (see also chapter 6.3). The two basic electromagnetic constants appear in all laws of electricity and magnetism, respectively, in Maxwell's four equations of electromagnetism (see section 6.). From this elaboration, it becomes cogent that the new derivation of Newton's law of gravity from the mind, being an axiomatic application of the Universal Law, carries a significant cognitive advantage when compared to the classical newtonian presentation. **It is the key to the integration of gravitation with electromagnetism** (see below)<sup>106</sup>.

As we can experimentally determine the speed of light  $c$ , we can calculate the *circumference*  $S_U$  of the visible universe, respectively, its *radius* within mathematics (see below). This example convinces us that empiricism is a tautology of the Law. Equation (33) confirms the basic statement of the new axiomatics: all we can do in physics is to compare the space-time of one system, defined as a reference system, with the space-time of another system (principle of circular argument). In Newton's law of gravity, the space-time of the photon level is introduced as a reference system in an unconscious manner: the two quantities,  $LRC = c^2 = [2d\text{-space-time}]$  and  $S_U = [1d\text{-space}]$ , are natural constants of reference belonging to the photon level (recall the definition of the SI units for space and time, meter and second, from a specific photon system). These quantities are compared with the space-time,  $E = m_1m_2$ , and space,  $r^2 = [2d\text{-space}]$  of any particular gravitational interaction between two material objects. The result of this interaction is regarded in the new axiomatics as a new distinct system (axiom of reducibility).

In fact, Newton's law of gravity is a rule of three. The choice of the physical quantities in such presentations is voluntary - within mathematics, we can define an infinite number of abstract secondary quantities of space-time (degree of mathematical freedom) - hence the seeming diversity of traditional

---

<sup>106</sup> While discussing with physicists on numerous occasions the advantages of the new physical axiomatics, I use to draw their attention to derivation (33) and try to explain to them its revolutionary character. However, I was surprised to make the experience that none of them was able to comprehend this breakthrough. Finally, I came to the conclusion that most physicists do not grasp their own subject of study, firstly, because they do not keep in mind the physical theory, which they have studied for many years; secondly, they are not aware of the inherent shortcomings, which this discipline carries as a historical burden, although some of these have been elaborated by many famous physicists in various publications throughout the 20th century.

physical laws. For instance, we can get the **radius of the visible universe**  $R_U$  from the circumference  $S_U$  in equation (37) within geometry as follows:

$$R_U = S_U/2\pi = 2.14 \times 10^{26} m \quad (34)$$

This is another new cosmological constant of fundamental importance. At present, this distance is roughly estimated in astrophysics by using Hubble's law to measure the redshift-distance relations for selected galaxies. From this distance, imagined as a straight line, the hypothetical "age" of the universe is calculated. We shall discuss in cosmology why this approach is a pure nonsense - space-time (the universe) is infinite, that is, it is *eternal*. Only the visible universe is finite - however, as previously said, there are infinite visible universes in space-time (see section 9.).

The actual dimensionality of the *universal gravitational constant*  $G$  as given in (33) is that of acceleration (3), that is, it is another physical tautology:

$$G = \frac{[2d - space - time]}{[1d - space]} = g_U = [1d - space - time]f = [1d - space] \quad (35),$$

For this reason, we also call it the **universal gravitational acceleration**  $g_U=G$ . When we set  $f^2 = SP(A) = 1$ , we can also express  $G$  as a *distance* (static approach). This is the freedom of our mathematical consciousness.

The ontology of Newton's law of gravity from our mathematical consciousness is paradigmatic for all physical laws. For example, we can trace the same pattern of presentation in **Coulomb's law**  $F = kq_1q_2/r^2$  that is a basic law of electricity. Its similarity to the law of gravity was acknowledged a long time ago, although no logical explanation has been put forward for this remarkable coincidence. The reason for the similar expression of the two laws is the application of the axiom of reducibility. In the new axiomatics, we regard *mass* and *charge* as abstract U-subsets of the primary term that belong ontologically to the mathematical set "structural complexity":  $m$  and  $q \Rightarrow K$ , (" $\Rightarrow$ " is a symbol for "belonging"). However, charge and mass are not identical quantities:  $m$  is an energy relationship, while  $q$  is an area relationship. We shall show in electromagnetism (chapter 6.2 & 6.4) that the **Coulomb constant**  $k = 1/4\pi\epsilon_0 = E/4\pi$  is a subset of the primary term, defined within the framework of geometric formalism, and has the same dimensionality as the gravitational constant  $G$  (see also 6.3):

$$k = \frac{E_o}{4\pi} = \frac{[1d - space - time]f}{4\pi} = \text{circle} - \text{area} = \frac{\text{circumference}^2}{4\pi} = A = \frac{u^2}{4\pi} =$$

$$= \frac{[2d - space]}{[1d - space]} = [1d - space] \Rightarrow G_{static} \Rightarrow g_{U(static)} \quad (36),$$

when  $f^2 = SP(A) = 1$  (see equation (35)). Recall that  $pi$  is [1d-space]-quantity which is expressed as a dimensionless number in physics (inconsistency of mathematics). The geometric approach of Coulomb's law is cogent: the formula of Coulomb constant is borrowed from the geometry of the circle: the *area of circle*  $A$  (corresponds to  $k$ ) can be expressed as *square circumference*  $u^2$  (corresponds to the electric field of the photon level  $E = 1/\epsilon_0$ ) divided by  $4\pi$  (see chapter 6.4). This is a basic school stuff that has been known since antiquity - indeed, physics is to a large extent an iteration of geometry to the physical world by inventing new terms for well-known geometric definitions. We can use the same geometric formula to obtain the **circumference**  $S_U$  of the *event horizon* of the **visible universe** from equation (33) and (34):

$$S_U = \frac{c^2}{G} = \frac{U_U}{G} = \frac{a_p \lambda_A}{g_U} = 13,47 \times 10^{26} m, \text{ when } f = 1,$$

or

$$g_U S_U = a_p \lambda_A \quad (37)$$

In equation (37)  $\lambda_A$  is the wavelength of the basic photon  $h$  (see also chapters 3.8 and 3.9, as well as point 31.);  $a_p$  is its acceleration. This equation is of fundamental importance for an epistemological understanding of the Universal Law. It contains the following essential truth:

The **extent (space)** of the *visible universe*, as assessed by its constant circumference  $S_U$  (event horizon), is proportional to the  $LRC = c^2$  of the photon level, also defined as the *universal potential*  $U_U = c^2$ , and inversely proportional to the *universal gravitational constant*  $G$  that has the dimensionality of acceleration:

$$S_U = c^2/G \quad (37a)$$

This is, indeed, a remarkable result from a cognitive and philosophical point of view. We can regard the constant space of the visible universe, where life evolves, as the product of two **dialectically linked, opposite forces (potentials)**: 1) the universal potential of the photon level, which is responsible for

the **expansion** of the universe and 2) the gravitational acceleration, which is responsible for its **attraction** (contraction). This follows from the reciprocity of space and time. This property is manifested by all its subsets, such as the above mentioned quantities. The space (extent) of the visible universe, perceived as physical matter with volume that is imbedded in photon space-time, is thus not an *a priori* quantity of the physical world, as is believed in physics today - hence the elimination of empty geometric spaces in the new axiomatics -, but a dynamic product of two reciprocal LRC, respectively, forces. This holds for space-time as well as for its parts. Each system can be expressed as the product of two LRC that behave reciprocally (axiom of reducibility). The reciprocity of contiguous LRC reflects the reciprocity of space and time. In our particular case, we can write the reciprocity of the LRC of photon level and gravitational matter:  $S_U G = U_G = (-) U_U = (-) c^2$ . Both levels are contiguous U-subsets of space-time - they cannot be distinguished in real terms, but only within mathematics. This is the actual epistemology of gravitation as an "action at a distance". Mathematically, equation (37) is an application of Newton's third law of *actio et reactio*, which in its turn is an application of the *axiom of reducibility*.

The primary idea of space-time as a reciprocal, closed interaction of space and time was clearly perceived for the first time by Heraclitus - he explained the world as a result of "striving opposite forces"<sup>107</sup>. He called this insight "**Logos**", which means word, idea, logic, Universal Law etc. This concept was basic to *caesaropapism* that was the only accepted principle of self-organisation of society for many centuries (late Roman empire, Hellenism, Byzantine empire, Vatican, Absolutism, Russia as Third Rome etc.). It enjoyed renaissance in Modern Times through *Hegelian dialectic*, from which *dialectical materialism* emerged as a predominant social doctrine of the 20th century. Various partial theories in bio-science, such as *Darwinism*, have also evolved from this concept - Darwin's "striving of species" is a pleonasm of Heraclitus' "striving of forces". In economics, the perception of the reciprocal

---

<sup>107</sup> See Frammenti in L. de Crescenzo's *Panta rei*: "1) Non bisogna mai dimenticare che la *querra* è comune a tutte le cose, che la *quistizia* viene fuori dalla *lotta*, e che tutto accade secondo *contesa* e *necessità* (Origene, *Contro celso*, 6,42. 2) L'intero (space-time) e il non intero (the parts), il convergente (*G*) e il divergente ( $LRC = c^2$ ), l'armonico ( $K_s$ ) e il disarmonico (dissipation), si tocano. Da tutte le cose ne sorge una sola, e da una sola possono sorgere tutte (Pseudo-Aristotele, *Sul mondo*, 396, b20-22). 3. Il divino è giorno e notte, estate e inverno, guerra e pace, sazietà e fame; e, similmente al fuoco, ogni volta che viene mescolato a un profumo, prende un nome *diverso* (different methods of presentation of space-time that have led to the present confusion in physics). (Ippolito, *Confutazione*, 9,10,8). 4) La strada che va in su è la stessa che va in giù. (Ippolito, *Confutazione*, 9,10,4). 5) Nel cerchio si concatenano il principio e la fine (principle of circular argument). (Porfirio, *Questione omeriche*, "Illiade", 14, 200) etc.

behaviour of LRC, e.g. the monetaristic level versus the level of production, determines the macroeconomic approach and renders various political theories on the adequate regulation of the free market economy (see also point. 44.). Independent of the specific presentation of such interactions between various levels, the vested *archetype* behind such concepts is equation (37) - we realize that structure (space) is a product of two reciprocal, dynamic forces (potentials) and that the finite lifetime of forms - be they material or ideal - is a function of their harmony. Any disharmony leads to dissipation (*pantarei*). This aspect will be covered in wave theory, where we shall precisely explain what we mean under “harmony“ and “disharmony“ (see also KAM-theorem in volume I). This is undoubtedly the most radical simplification of modern scientific and common outlook. Once fully comprehended, it will transform mankind and will open the possibility of its evolution to transgalactic species. It also explains the eschatology of science (and here especially of mathematics) as an inherent striving of man for perfection (see volume I). The ultimate goal of this endeavour is the survival of mankind and not the deplorable run for academic titles that seems to be the chief preoccupation of scientists today. As long as most scientists stick to a primitive opportunism as symbolized by the principle of “publish or perish“, while at the same time they are discarding the survival of mankind as an endpoint of scientific endeavour, they are merely producing wasteful publications and contributing to the perishment of mankind (for further reading on this theme see volumes I, III & IV). This is the logic of the Universal law that nobody can reject<sup>108</sup>.

Human intuition has always perceived the Universal Law - in philosophy, science, art and religion. The Universal Law has been discovered infinite times in the past. Unfortunately, until its present, ultimate discovery and development to a general physical and mathematical axiomatics, philosophers and scientists have only furnished partial solutions. So far, none of them has been able to define the primary term in an irrevocable manner. This is the principal fallacy of religion, philosophy, physics and mathematics. It has precluded the establishment of a unified theory of science for the benefit of mankind.

If we rearrange Newton’s law of gravity as expressed in formula (37), we obtain the universal equation as a *rule of three*:

$$g_U/a_p = \lambda_A/S_U \quad (37b)$$

Equation (37b) illustrates the reciprocal character of space and time that is intuitively perceived as a “striving of forces“. The acceleration of the gravitational level  $g_U$  and the acceleration of photon level  $a_p$ , being one-dimensional

---

<sup>108</sup> This reproach also applies to my scientific activities before the discovery of the Universal Law.

quantities of space-time,  $g_U, a_p = [1d\text{-space-time}]f = E_A f$ , behave reciprocally in relation to their corresponding spaces as assessed by the wavelength of the basic photon  $\lambda_A$  and the circumference of the visible universe  $S_U$ .

Equation (37b) is a prototype of another application of Newton's law of gravity. We can solve the law for the earth's gravitation  $g$  in the following manner  $g = GM_E/R_E^2$ . This is a well known formula that describes the earth's gravitation as a product of the universal gravitational acceleration  $G = g_U$  and the structural complexity of the earth:  $M_E/R_E^2$ . In this formula  $R_E$  is the *earth's radius* and  $M_E$  is the *earth's mass*. The common mathematical origin becomes evident when we rearrange this equation:

$$g = U_G = G \frac{M_E}{R_E^2} = G \frac{4\pi R_E}{3} \left[ \frac{M_E}{V_E} \right] = \frac{2}{3} G S_E \rho_E = \frac{2}{3} \frac{c^2}{S_U} S_E \rho_E \quad (38),$$

where  $\rho_E = M_E/V_E$  is the density of the earth ( $M_E = 5,98.10^{24} \text{kg}$ ,  $R_E = 6,38.10^6 \text{m}$ ,  $V = 4/3 \pi R_E^3 =$  volume of the earth)<sup>109</sup> and  $S_E = 2\pi R_E$  is the circumference of the earth  $S_E$ . The quotient  $2c^2/3S_U$  is a **new cosmological constant**  $k_U = 2c^2/3S_U = 2/3G$ , as  $U_U = c^2 = \text{cons.}$  and  $S_U = \text{cons.}$  ( see equation (33)):

$$g = U_G = k_U S_E \rho_E \quad (38a)$$

The earth's gravitation can be expressed as  $g = [1d\text{-space-time}]f$  or  $U_G = [2d\text{-space-time}]$ . Both quantities can be presented as equivalent mathematical terms:  $U_G = g f$ ; when  $f = 1$ , then  $U_G = g$  ( $E = E_A$ ). In equation (38a), the earth's gravitation  $g$  is a constant product of three other constant quantities. Indeed, all experiments confirm that  $g$  is constant.

Let us now assume that the universe expands, as is done in the standard model of cosmology. This would mean that  $S_U$  will increase. In this case,  $k_U$  will decrease. This would say that the earth's gravitation will decrease as the universe expands. However, there is no evidence that  $g$  changes in a similar way. This is a very strong evidence that the universe does not expand. This is also proven by the constant event horizon or circumference  $S_U$  of the visible universe<sup>110</sup>. We shall substantiate this fact in cosmology by obtaining many new constants that confirm the closed and constant character of the universe.

<sup>109</sup> The data is from Kane & Sternheim's Physics, John Wiley & Sons, New York, 3 ed., 1988, p. 62-63.

<sup>110</sup> Any theoretical net expansion of the physical universe can only be perceived within the boundaries of the visible universe, which are determined by the speed of light. As long as  $c$  remains constant, there is no possibility of determining such an expansion. However, we cannot wholly exclude the possibility of an expanding three-dimensional universe, while the speed of light is intentionally hold constant. This aspect goes beyond present-day physics and involves new knowledge of metaphysics that is not a topic of this volume. Here, we restrict ourselves to the classical present-

Equation (38a) is of paramount importance for celestial mechanics and cosmology. It describes a simple relationship between the **density**  $\rho_E$  as a fundamental quantity of physics (see equation (47)) and the *space (extent)* of any particular celestial object, including the visible universe itself:

$$\rho_E = \frac{g}{k_U} \times \frac{1}{S_E} = \frac{U_G}{k_U} \times \frac{1}{S_E} = k \times S_E^{-1} \quad (38b)$$

The **density** of gravitational objects is *inversely* proportional to their *extent (space)*.

The new **constant of proportionality**  $k$  already contains the constant space-time of the visible universe, to which the space-time of any gravitational object can be compared (principle of circular argument). We have shown that this is precisely the objective of Newton's law of gravity. In this case,  $k = g/k_U$  is a constant because  $g = U_G$  and  $k_U$  are also constant. Equation (38b) holds for any gravitational object, such as planets, stars, black holes, or galaxies. We call it the "**universal equation of gravitation**" because it is the generalized form of Newton's law of gravity. For instance, we can apply it to **black holes**. These gravitational objects have the greatest density, we know of. At the same time the *event horizon* of black holes as assessed by the circumference  $S$ , also known as "world line" (pleonasm), where matter is transformed into another form of condensed energy, is extremely small. For this reason a black hole is usually described as a space singularity. The gravitational potential of black holes is proportional to their density  $U_G \approx \rho_E$  (38a). It is considered to be the maximal local potential of gravitation that occurs in space-time.

The famous equation of *Chandrasekhar*, with which he determines the boundary conditions for the finite lifetimes of stars, is of the same mental ontology - it describes the mean density of stars as a function of space. What holds in macrocosm, must also hold in microcosm: for instance, Schrödinger's wave equation of quantum mechanics assesses the *probability density (energy density)* of the particle as a function of one-dimensional space (see chapter 7.2).

*Exercises:*

1. Deduce the *fine structural constant of gravitation* (Feinstrukturkonstante der Gravitation)  $\alpha = 2\pi G m_{pr}^2 / hc$  ( $m_{pr}$  = mass of proton) from the mind by expressing it in the new space-time symbolism. Show that this constant,

---

tation of physical and cosmological phenomena and the numerous logical blunders that should be eliminated from physics, before mankind is in a position to develop a broader view of what energy really is.

which appears in Chandrasekhar's equation of finite lifetime of stars, is a coefficient (absolute, dimensionless constant) of vertical energy exchange. For further help see the derivation rule of absolute constants in chapter 9.9.

2. Explain Einstein's "greatest blunder of his life", the **cosmological constant  $\Lambda$** . Show that it has its origin in the universal equation of gravitation (38b). Define this quantity within mathematical formalism.

*Solution:* Einstein's model of the universe departs from the theory of relativity and describes space-time, that is, photon level and matter level, as a relationship between *mass density*  $\rho = SP(A)/[1d\text{-space}]$  and the *local change of space*. The latter is described as a local rate of expansion  $U_U = c^2$  and contraction  $g_{local}$  (see equation (37)). For this purpose, the empty Minkowski world is used as a reference frame. To balance the expanding and contracting forces that "bend space", Einstein introduced *ad hoc* his famous *cosmological constant*  $\Lambda$ . In the new axiomatics, it exhibits the dimensionality of square time  $\Lambda = f^2$ . This quantity is obtained within mathematical formalism by applying the differential operation of "divergence" to any energy gradient  $\phi = U$  that is presented as  $[2d\text{-space-time}]$ -quantity:  $LRC = [2d\text{-space-time}]$  (see Laplace-operator in chapter 6.6):

$$diva = \Delta a = \frac{d^2\phi}{d^2r} = \frac{U}{r^2} = \frac{LRC}{r^2} = \frac{[2d - space - time]}{[2d - space]} = f^2 \quad (39)$$

$\Lambda = \Delta a = f^2$  is the second derivative of any LRC with respect to space. In recent modifications of Einstein's model (Zel'dovich, 1968; Zel'dovich & Novikov, 1983), the cosmological constant is interpreted as a fluid with *effective mass density*:

$$\rho_o = \frac{\Lambda}{8\pi G} = \frac{f^2}{8\pi[1d - space - time]f} = \frac{SP(A)}{[1d - space]} \quad (40),$$

where  $f^2/8\pi = SP(A)$ . When we solve the universal equation of gravitation as applied to the earth (38) for the density, we obtain the same result:

$$\rho_o = \frac{3g}{2GS_E} = \frac{3[1d - space - time]f}{2[1d - space - time]f[1d - space]} = \frac{SP(A)}{[1d - space]} \quad (40a)$$

Einstein's equation of the effective mass density, in which the cosmological constant appears as square time  $f^2$ , is a pleonastic variation of the new universal equation of gravitation within mathematical formalism (see also (9a)). The latter is an application of Newton's law of gravity, which itself is an application

of the Universal Law for gravitation (28). Both presentations are iterations of the quantity “density“ (47). The search for explanation in the complexity of mathematics has been the chronic syndrome not only of Einstein, but also of all physicists before and after him and has led to the present intellectual fatigue of this science<sup>111</sup>. For panacea we recommend the correct application of the Universal Law.

How can we explain  $\Lambda$  in terms of knowledge? Time is the dynamic constituent of space-time that gives us information on the number of exchanged actions potentials. If we regard space, contrary to Einstein, as inhomogeneous, the local density of actual space-time systems and levels will only depend on the number of the action potentials per space  $\rho \approx f^2$ . The square time assesses this constituent as a product of the interaction between two entities  $f^2 = f \times f$  (axiom of reducibility). Thus Einstein’s cosmological constant is equivalent to the angular acceleration in its conventional presentation  $\Lambda = \alpha = f^2$  (18). The bigger the angular acceleration  $\alpha = E = [1d\text{-space-time}]$   $f = E_A f$ , the smaller the space  $E = 1/[1d\text{-space}]$ . We shall show in quantum mechanics that this is the actual mechanism of building elementary particles - their space is inversely proportional to the angular acceleration as a quantity (action potential) of energy (see Bohr’s model of energy quantization in chapter 7.1). In this case, the time can be set equivalent to the number of revolutions,  $1rev = 1E_A$ , or to any portion of the revolution  $1^\circ = 1E_A$ . This is a very useful approach, which we shall employ to explain the mass of the elementary particles as a function of the mass of the basic photon (chapter 3.9). The same paradigm is also used by Schrödinger in his famous wave equation of quantum mechanics, where he describes the energy density of the particles as a function of Planck’s constant (chapter 7.2).

From cosmology to quantum mechanics, we encounter the same mathematical pattern - the new theory of the Universal Law establishes new links between the various physical disciplines and streamlines our physical knowledge. This is the privilege of any axiomatics based on inner consistency and lack of contradiction: due to its transitiveness, it integrates all natural science under one term, one Law. One of the chief achievements of the new theory in this respect is to highlight the energy exchange between matter and photon space-time, by showing that all properties of matter are determined by the properties of photon space-time and vice versa, so that there is principally no difference between matter and photon space-time - matter is temporarily bound photon space-time. Both levels are interrelated and build the unity of space-time. Below, we shall present a key example on behalf of this insight.

---

<sup>111</sup> This is an allegory of CFS (chronic fatigue syndrome) that has emerged as a new disease of modern industrial life and can be successfully treated in the light of the Universal Law (see volume III).

## The Radius and the Mass of the Earth are Functions of Photon Space-Time

**Gravitation** is a manifestation of the **vertical energy exchange** between the level of matter and the photon level. This energy exchange allows the comparison of the space-time of any material system to photon space-time, which is the universal reference system at present. We have proved this for the SI units, second and meter. Another fundamental system of the photon level, which can be precisely quantified, is the “visible universe“ with the circumference  $S_U = c^2/G$  (33). Therefore, we can use the visible universe as a system of reference to measure the space-time of any other system by employing the universal equation of gravitation (38b). This approach has the following advantage: the visible universe has a constant extent for any observer in the universe. This is the cosmological principle as an application of the principle of last equivalence. It is the biggest system of space-time we know of. As all systems of space-time are U-sets, the visible universe includes all gravitational objects we can register, for instance, by the Hubble Space Telescope.

We depart from equations (33) to (37b), which contain explicitly or implicitly the gravitational constant  $G$  of Newton’s law of gravity. This circumstance gives us the possibility of employing the photon system “visible universe“ as a reference system for measuring the space, time, or space-time of any gravitational system within this system. This particular approach simplifies our cosmological outlook dramatically. For instance, we can obtain the radius of the earth from the space-time of the visible universe and vice versa. We can link the application of the Universal Law for the visible universe  $G = c^2/S_U$  (33) to Newton’s application of the Law for the earth  $G = gR^2/M$  (27), where  $R$  is the earth’s radius and  $M$  is the earth’s mass, and solve a new equation for the **earth’s radius**:

$$\begin{aligned}
 R^2 &= \frac{c^2}{S_U g} M = \frac{G}{g} M = \frac{[1d - space - time]f}{[1d - space - time]f} M = SP(A)M = \\
 &= SP(A)K_s = SP(A) \times SP(A)[2d - space] = SP(A)[2d - space]. \quad (41)
 \end{aligned}$$

Equation (41) illustrates the inner consistency and absence of contradictions of the new axiomatics. We obtain the exact dimensionality for each abstract quantity of space-time, such as  $M$  ( $K_s$ ),  $G$ ,  $g$ , or  $R^2$  because they have been axiomatically deduced from the primary term. It is important to observe that  $G$  contains the **total** information on photon space-time and can be easily obtained in a local experiment, such as the free fall. We shall prove that the same is true for the basic natural constants of electromagnetism,  $\epsilon_0$  and  $\mu_0$ .

(6.3), which contain valuable information on the space-time of neutron stars, black holes etc. When we set the values for the natural constants,  $c^2$ ,  $S_U$ ,  $g$ , and  $M$ , in equation (41), we obtain for the earth's radius the value of  $R = 6377 \times 10^3 \text{ m}$ . In fact, the radius is a little bit smaller, as the earth is not an ideal sphere  $R = 6370 \times 10^3 \text{ m}$ .

We can now depart from the radius and obtain the mass  $M$  of the earth. As with all definitions and exercises in physics, this calculation is based on the principle of last equivalence. This is a manifestation of the closed character of space-time. For this purpose, we take equation (29)  $G = c^3/E_{AU}$  and express the universal action potential  $E_{AU}$  (30) with the quantity mass  $E_{AU} = M_{AU} f_p$ , where  $f_p = 1 \text{ s}^{-1}$ . We can express the speed of light by its constituents as given for the basic photon:  $c = \lambda_A f_p$ , where  $f_p = 1 \text{ s}^{-1}$ . We obtain for the gravitational constant  $G = c^2 \lambda_A / M_{AU}$ . When we link this equation to equation (27) and solve it for the **earth's mass**, we again obtain the same epistemological result: physics is a comparison of the space-time of physical systems or quantities thereof:

$$\begin{aligned}
 M &= \frac{gR^2}{GS_U \lambda_A} M_{AU} = \\
 &= \frac{[1d - space - time] f [2d - space]}{[1d - space - time] f [1d - space] [1d - space]} M_{AU} = \\
 &= SP(A) M_{AU} \tag{41b}
 \end{aligned}$$

This application of the Law can be experimentally verified.

### 3.8 MASS AND MIND

**Mass** does not exist - it is an *abstract* term of our consciousness (object of thought) that is defined within mathematics. The origin of this term is energy (space-time). Mass is a comparison of the space-time of any particular system  $E_x$  to the space-time of a reference system  $E_r$  (e.g. 1 kg) that is performed under *equal* conditions (principle of circular argument):  $m = E_x/E_r = SP(A)$ , when  $g = cons.$  (see point 41.). When this comparison is done for gravitation, it is called *weighing*. The ratio that is built is a static relationship that does not consider energy exchange although it is obtained from an energy interaction, such as weighing. This explains the traditional presentation of mass as a scalar. We can call the space-time of a reference system "1kg" or "1 *space-time*" without changing anything in physics. In the new axiomatics, we ascribe mass for didactic purposes to the new term "structural complexity":

when  $f = 1$ ,  $m = K_s = SP(A)[2d\text{-space}] = SP(A)$ . In this case  $[2d\text{-space}] = SP(A) = 1$  is regarded as a spaceless “centre of mass” within geometry.

The definition of mass in classical mechanics is as follows: “Mass is an intrinsic property of an object that measures its resistance to acceleration.”<sup>112</sup> The word “resistance” is a circumlocution of reciprocity:  $m \approx 1/a$ . This definition creates a vicious circle with the definition of *force* in Newton’s second law: „A force is an influence on an object that causes the object to change its velocity, that is, to accelerate”<sup>113</sup>:  $F \approx a$ . From this circular definition, we obtain for mass  $m \approx 1/F$ . If we consider the number “1” as a unit of force,  $F_r = 1$  (reference force), we get for the mass  $m = F_r/F$ . This is the vested definition of mass as a relationship of forces. As force is an abstract U-subset of energy  $F = E/s = E$ , when  $s = 1$  unit, e.g.  $1m$ , we obtain for mass a relationship of two energies:  $m = E_r/E = SP(A)$ . We conclude:

The physical quantity **mass** is, per definition and method of measurement, a **relationship of two energies**. The gravitational energy relationship  $1kg$  is the SI reference system with respect to earth’s gravitation that can be replaced by any other reference system.

It is important to observe that the definition of mass is equivalent to the *definition of absolute time*  $f = E/E_A = SP(A)$ . From a mathematical point of view, mass can be regarded as a quantity of time. The definition of mass follows the principle of circular argument. If we rearrange  $m = 1/a$  to  $ma = 1 = F = E = \text{reference space-time}$  (Newton’s second law) we obtain the principle of last equivalence. This elaboration of the definition of mass proves again that mathematics is the only method of definition and measurement of physical quantities. This knowledge is basic for an understanding of various mass measurements in physics that have produced a number of fundamental natural constants. We shall derive some of these constants below by applying the universal equation. The definition of *relativistic mass* follows the same pattern. We shall discuss this quantity extensively in conjunction with the traditional concept of space-time in the theory of relativity (see chapter 8.3 & equation (43)).

The equivalence between the **method of definition** of physical quantities and the **method of their measurement**, being mathematics in both cases, can be illustrated by the measurement of **weight**  $F = E$  ( $s = 1$ ). The measurement of weight is an assessment of gravitation as a particular energy exchange. The instruments of measurement are *scales*. With scales we weigh *equivalent* weights  $F_r = F_x$  at equilibrium; as  $s = 1 = \text{cons.}$ , hence  $E_r = E_x$ . This is Newton’s third law expressed as an energy law according to the axiom of conservation of

---

<sup>112</sup> PA Tipler, p.80

<sup>113</sup> PA Tipler, p.80

action potentials. The equilibrium of weights may be a direct comparison of two gravitational interactions with the earth, or it may be mediated through spring (elastic) forces. As all systems of space-time are U-subsets, the kind of interim force is of no importance: any particular energy exchange, such as gravitation, can be reduced to an interaction between two interacting entities (axiom of reducibility).

Let us now consider the simplest case when the beam of the scales is at balance. In this case, we compare the energy  $E_r$  (reference weight) and  $E_x$  (object to be weighed), as they undergo equivalent gravitational interactions with the earth (equal attractions). The equivalence of the two attractions is visualized by the balance, e.g. by the horizontal position of the scale beam. This is an application of the principle of circular argument - building of equivalence and comparison. All physical experiments assess real space-time interactions according to this principle. This also holds for any abstract physical quantity, with which any particular energy interaction is described.

Let us now describe both interactions, the reference weight  $E_r$  and the object to be weighed  $E_x$ , with the earth's gravitation according to the axiom of reducibility. For this purpose, we express the two systems in the new space-time symbolism. The space-time of the earth  $E_E$  is given as gravitational potential:  $E_E = LRC_G = U_G = [2d\text{-space-time}]_G$ . The space-time of the two gravitational objects,  $E_r$  and  $E_x$ , is given as mass (energy relationship):  $E_r = m_r = SP(A)_r$  and  $E_x = m_x = SP(A)_x$ . As the two interactions are equivalent when the scales are at balance, we obtain the universal equation for each weighing:

$$E = E_r E_G = E_x E_G = SP(A)_r [2d\text{-space-time}]_G = SP(A)_x [2d\text{-space-time}]_G \quad (42)$$

We can now compare the two gravitational interactions by building a quotient within mathematics:

$$K = SP(A) = \frac{SP(A)_x [2d\text{-space-time}]_G}{SP(A)_r [2d\text{-space-time}]_G} = \frac{SP(A)_x}{SP(A)_r} = \frac{m_x}{m_r} = x(\text{kg}) \quad (42a)$$

We obtain the Universal Law as a rule of three. Recall that we have used the same equation to obtain the absolute constants (coefficients of vertical and horizontal energy exchange, see points 35. & 38.). "Weighing" is thus based on the equivalence of the earth's gravitation for each mass measurement, i.e.,  $U_G = g = \text{cons}$ . If  $U_G$  were to change from one measurement to another, we would not be in a position to perform any adequate weighing, precisely, we would not know what the energy relationship (masses) between distinct objects really are.

Any assessment of space-time requires, firstly, the building of equivalences and, secondly, the comparison between two entities. This is the principle of

circular argument as the only operational method of physics and mathematics. We use the same principle to define a level as an abstract U-subset of space-time, consisting of equivalent systems or action potentials. The principle of circular argument is the only cognitive principle of consciousness. Without it, the world would be incomprehensible. The above statement is a tautology - there is no possibility to distinguish between "cognition" and "consciousness". Such tautologies reveal the closed character of space-time - the principle of circular argument is the universal operation of the mind with respect to the primary term<sup>114</sup>.

Equation (42a) exemplifies as to how one obtains the "certain event" in physics:  $m_r = m_x = 1\text{kg} = SP(A) = \text{certain event} = 1$ . If  $m_r = SP(A) \geq 1$ , the "1 object" to be weighed is equivalent to  $n$  (kg), that is,  $1 = n$  ( $n =$  all numbers of the continuum). Within mathematical formalism we can define any number of the continuum, which stands for a system of space-time, as the certain event and assign it the number "1". This mathematical procedure is fairly common in physics. We shall show below that the basic quantity "1 mole" is defined in the same way. Any definition of physical units, e.g. SI units, follows this pattern. The standard energy system of 1kg contains, for instance, 1000g, 1 000 000 mg and so on<sup>115</sup>. We can build an equivalence between the certain event „1“ and any other number of  $n$ , such as 1000 or 1 000 000 by adding voluntary names of units to these numbers, which stand for real space-time systems: e.g.  $1\text{ kg} = 1000\text{ gram}$ .

Thus the primary idea of space-time as a conceptual equivalence is introduced in mathematics not through numbers (objects of thought), which are universal abstract signs that can be ascribed to infinite real objects, but through descriptive terms (words), such as "kilogram", "gram" and "milligram". These descriptive terms establish the link between hermeneutic mathematics and the real world. Such terms are of precise mathematical character - when we apply the principle of circular argument to the words "kilogram" and "gram", we obtain a dimensionless quotient  $\text{kilogram}/\text{gram} = 1000$  that belongs to the continuum. From this we conclude that human language can be "mathematized" when the individual words, respectively, their connotations, are axiomatically defined from the primary term by the principle of circular argument.

Instead of the voluntary units, kilogram and gram, we can choose the space-time of the **Planck's constant  $h$**  as a reference unit of mass  $E = h/c^2 = m_p = SP(A) = 1$  by comparing it with itself. In this case, we follow the pattern of the SI system, which uses photon space-time as a reference system for the basic units of space and time. As mass is a space-time relation-

---

<sup>114</sup> This physical conclusion is of paramount importance for human gnosis and eschatology. These aspects are covered in a separate book on esoteric gnosis.

<sup>115</sup> One dollar as the certain event,  $1\$ = SP(A) = 1$ , is equivalent to 100 cents and 1 million dollars as another certain event,  $1\text{ million} = SP(A) = 1$ , is equivalent to 1 000 000 \$.

ship, that is, it only contains space and time, we should also use photon space-time as the initial reference system for the definition of mass and eliminate the present reference system of earth's gravitation, given as 1kg.

Since these reference systems are transitive, we can compare the space-time of the basic photon with the space-time of the standard system of mass, called 1kg, and obtain a different quotient or dimensionless number (see equation (44)). We can then express the mass of all material systems, for instance, the mass of all elementary particles and macroscopic gravitational objects, in relation to the mass of  $h$  in kg and obtain the same mass values as assessed by direct measurements. The reason, why these results agree, is that mathematics is the only method of definition and measurement of mass or any other quantity. Mathematics is a *transitive* axiomatic system due to the closed character of space-time - it works both ways. One can either depart from the definition of mass and then confirm it experimentally in a secondary way or assess mass as a space-time relationship of real systems and then formalize this measurement into a general definition of this quantity. In both cases, the primary event is the mathematical definition according to the principle of circular argument.

As we can set  $m_p = h/c^2 = 1$  and  $m_p = (h/c^2) \times 1kg$ , the space-time of Planck's constant  $h$  can be chosen as the initial reference system of mass measurement. This is a consequent step based on the knowledge that space-time has only two dimensions, the initial reference frame of which is photon space-time. All other units can be derived from these two units. This interdependence can be easily demonstrated by presenting the *Lorentz factor* of relativity (equation (43-4)), assessing the relativistic changes of space and time in electromagnetism and the theory of relativity (chapters 8.2 & 8.3), as the **universal equation of mass measurement** (see also equation (42a)):

$$\begin{aligned}
 y^{-1} = SP(A) &= \sqrt{\frac{c^2 - v^2}{c^2}} = \sqrt{\frac{dV^2}{c^2}} = \sqrt{\frac{dLRC_x}{LRC_p}} = \sqrt{\frac{SP(A)[2d - space - time]_x}{[2d - space - time]_p}} = \\
 &= \frac{SP(A)[1d - space - time]_x}{[1d - space - time]_p} = \frac{E_x}{E_p} = \frac{dV}{c} = \frac{m_x}{m_p} = x(kg) \quad (43)
 \end{aligned}$$

Departing from this equation, we shall prove in chapter 8.4 that *mass at rest* is a synonym of the certain event, while *relativistic mass* is a synonym of Kolmogoroff's probability set. In this way we shall accomplish the integration of the basic physical disciplines within mathematics.

As we see, physics can be fairly simple in terms of knowledge when the concepts of this discipline are axiomatically arranged. Equation (43) confirms that we can present space-time one-, two-, or  $n$ -dimensionally without affecting the basic conclusion of our axiomatics: The only thing we can do in physics is to compare the space-time of one system or a quantity thereof with that of

another system. From a didactic point of view, this refrain should be as often reiterated as that in Ravel's Boléro, so that even the most conservatively thinking physicist will finally grasp it. Below, we shall substantiate this conclusion by presenting new key derivations that will facilitate our understanding of the quantity "mass".

### 3.9 MASS, MATTER AND PHOTONS (ND)

As the quantity "mass" is a space-time relationship, there are infinite masses in space-time. We shall derive some basic, constant space-time relationships, which are conventionally described as "natural constants". Thus we shall prove that space-time is a closed entity so that we can derive any constant mass from any other constant mass. The same is true for the magnitude of any other quantity of an actual space-time relationship. As such constants are part of distinct physical laws, which until now could not be integrated, we shall demonstrate how physics **can be unified** (see Table 1).

For this purpose we shall employ the new space-time symbolism and neglect the SI units that obscure our physical knowledge. The non-mathematical term "kilogram" will be ascribed to the final result, so as to make clear that we have selected the space-time of 1 *kilogram* as a real reference system. The reason for this is the use of conventional data from the literature, which are given in SI units. We begin with the **mass  $m_p$  of Planck's constant  $h$** , which is a space-time relationship of this photon system with the SI unit 1 *kg*. In the new axiomatics, we call Planck's constant  $h$  the "**basic photon**". This smallest constant amount of photon energy is the **elementary action potential** of the photon level. The energy of any photon (electromagnetic wave) as a system of this level can be assessed by applying the universal equation:  $E = E_A f = hf = [1d\text{-space-time}][1d\text{-space}]f$ . This proves that Planck's equation is an application of the Law for photon space-time. Each action potential can be regarded as a system of space-time (point 14.). This also holds for the basic photon:  $h = E = SP(A)[2d\text{-space-time}]_p$ . When we set its space-time in relation to photon space-time  $E_p = c^2 = [2d\text{-space-time}]_p = LRC_p$ , we obtain the space-time relationship  $SP(A)$  of this elementary action potential as **mass** in *kg*:

$$m_p = \frac{h}{c^2} = \frac{h\mu_o}{4\pi k} = h\mu_o\varepsilon_o = \frac{SP(A)[2d\text{-space-time}]_p}{[2d\text{-space-time}]_p} =$$

$$= SP(A) = 0.737 \times 10^{-50} \text{ kg} \quad (44)$$

The **constant  $m_p$**  is the **mass of the basic photon**. It is a new fundamental constant obtained within mathematics; it assesses the constant space-time of this real photon system in relation to the real, surrogate SI system “1 kg”, according to the principle of circular argument. All systems have a constant space-time because they contain the whole as an element and express its properties - in this case, the constancy of space-time. The space-time of any system can only be assessed in comparison with the space-time of another system (principle of circular argument). Such space-time relationships are always constant. Equation (44) illustrates this principle, which is also basic to the Law:  $f = SP(A) = E/E_A = m$ . As previously noted, mass can be regarded as time within mathematical formalism (freedom of mathematical consciousness).

The time and space of the basic photon are thus natural constants:  $f_p = 1s^{-1}$  and  $\lambda_A = c/f_p = [1d\text{-space-time}]_p/f = [1d\text{-space}]_p \approx 3 \times 10^8 m$ . In point 31., we have shown that we can alternatively select the wavelength  $\lambda_A$  of the basic photon as a reference unit of length and compare the anthropocentric length unit of  $1m$  with it. In this case we obtain the conversion factor:  $A = 1\lambda_A/1m = 2.99792458 \times 10^8$  as a dimensionless quotient. As space-time is closed, we can depart from any magnitude and acquire any other magnitude and vice versa. The same is true for mathematics - continuum is space-time. We can obtain any number from any other number as a relationship. All the constants which we shall derive in this book belong to the continuum - they are dimensionless numbers (quotients).

Equation (44) is a new, key derivation of the Universal Law. It integrates five basic physical constants by introducing the new constant  $m_p$ . These are: **speed of light  $c$** , **permeability of free space  $\mu_0$** , **permittivity of free space  $\epsilon_0$** , **Coulomb’s constant  $k$**  and **Planck’s constant  $h$**  (see Table 1). These constants are part of distinct laws, such as Coulomb’s law of electricity, Maxwell’s equations of electromagnetism, Planck’s equation of quantum mechanics and Einstein’s mass-energy-equation of the theory of relativity. So far, these laws cannot be integrated. Thus a single application of the Universal Law integrates such heterogeneous physical disciplines as classical mechanics, electromagnetism, quantum mechanics and the theory of relativity. This is, indeed, a remarkable result that demonstrates the priority of the new theory over conventional physics.

In this process of physical integration, we have already derived Planck’s equation and Einstein’s law from the universal equation. Below, we shall prove that the other laws which are integrated in equation (44) are also applications of the Universal Law. This fact is anticipated by the above equation, which is a synthesis of the aforementioned laws. The five constants are abstract quantities of photon space-time and contain far more information about this level than is generally assumed. We shall discuss this issue in electromagnetism when we shall present for the first time the actual epistemological background of the two basic constants,  $\mu_0$  and  $\epsilon_0$  (see chapter 6.3).

Mass is a space-time relationship of systems, and space-time is a unity. We can depart from the basic photon and obtain the space-time  $E$  of any *elementary particle* of matter as “mass”:  $E/h = SP(A) = m$  and vice versa. This will be proven for **electron, proton** and **neutron**. These elementary particles of matter are open systems and exchange energy - we can also speak of mass - with the photon level: they absorb and emit photons. There are several laws that describe this energy exchange (see thermodynamics). We depart from the universal equation as a rule of three (36-1) and make use of the **Compton wavelengths** of the particles, which are known natural constants. We shall only derive the **mass of the electron  $m_e$** . The mass of the other particles is obtained analogously:

$$K_{e,p} = \frac{E_e}{h} = \frac{m_e}{m_p} = \frac{\lambda_A}{\lambda_{c,e}} = \frac{[1d - space]_p}{[1d - space]_{c,e}} = \frac{f_{c,e}}{f_p} = SP(A)$$

or

$$m_e = \frac{m_p \lambda_A}{\lambda_{c,e}} = m_p f_{c,e} = 9.109 \times 10^{-31} \text{ kg} \quad (45)$$

In this equation,  $\lambda_A = 2,99792458 \times 10^8 \text{ m}$  is the wavelength of the basic photon,  $\lambda_{c,e} = 2,42631058 \times 10^{-12} \text{ m}$  is Compton wavelength of the electron,  $f_p = 1(\text{s}^{-1})$  is the time of the basic photon (assessed as a wave frequency),  $f_{c,e} = c/\lambda_{c,e} = 1,23559 \times 10^{20}$  is the **Compton frequency** of the electron - a new constant -, and  $m_p$  is the mass of the basic photon (44). By applying the Law for the quantity mass, we obtain the *mass of the electron*. It is a basic constant that can be experimentally measured. Recall: we have used the same equation to obtain the absolute constants (coefficients) of vertical energy exchange (points 35. & 36.). In the same manner we can obtain the masses of the other elementary particles (see Table 1). The masses of the particles are basic not only to quantum mechanics, which is unable to explain them, but also to gravitation:

„So not only have we no experiments with which to check a quantum theory of gravitation, we also have no reasonable theory. Throughout the entire story there remains one especially unsatisfactory feature: the observed *masses of the particles, m*. There is no theory that adequately explains these numbers. We use the numbers in all our theories, but we don't understand them - what they are, or where they come from. I believe that from a fundamental point of view, this is a very interesting and serious problem.“<sup>116</sup>

The answer to this disturbing question, as put forward by the founder of QED, *Richard P. Feynman*, is fairly simple in the light of the new axiomatics:

<sup>116</sup> R.P. Feynman, QED, Penguin, 1985, p. 151-52.

space-time is continuum (primary axiom) and all constant numbers, which physicists obtain from experiments, are constant space, time, or space-time relationships that are introduced by themselves through mathematical formalism. The latter is the method of definition and measurement of all physical quantities as abstract U-subsets of the primary term.

Although the mass of the particles is initially defined within mathematics, this quantity can be experimentally verified. This holds true for all abstract physical quantities of space-time (unity of mathematics and physical world). We shall illustrate this basic insight with the classical experiment of **Compton scattering** that assesses the vertical energy exchange between electron level and photon level. For this purpose we shall use the *axiom of conservation of action potentials* as another presentation of the universal equation (see point 34.). We consider the electron and the basic photon as the elementary action potentials of two interacting levels:  $E_e = m_e c \lambda_{c,e}$  and  $h = m_p c \lambda_A$  by setting their time as the certain event:  $f_e = f_p = SP(A) = 1 = 1 \text{ particle}$ . This formalistic approach allows the building of equivalence between any two action potentials (principle of last equivalence for the parts):

$$E_e = h = m_e c \lambda_{c,e} = m_p c \lambda_A = SP(A)[1d\text{-space-time}][1d\text{-space}] \quad (45a)$$

When we rearrange this equation by eliminating  $c$ , we obtain equation (45) as a rule of three:

$$m_p = \frac{m_e \lambda_{c,e}}{\lambda_A} = 0.737 \times 10^{-50} \text{ kg} \quad (45b)$$

Mass can be regarded as a magnitude that gives us information on the **density** of space-time (see chapter 3.10) - the higher the density, the more energy (mass) per space. Figuratively speaking, space-time can be imagined as an accordion - the more folds per space ( $f$ ), the higher the energy  $E \approx f$ . The Compton frequency  $f_{c,e}$  of the electron is much greater than that of the basic photon  $f_p = 1$ , namely  $1.23559 \times 10^{20}$  times. The same holds for its mass:  $m_e/m_p = f_{c,e}$ . The space of the electron is correspondingly smaller than the space of the basic photon:  $\lambda_{c,e}/\lambda_A = f_p/f_{c,e} = 1/1.23559 \times 10^{20}$ . Such constants reflect the reciprocity of space-time - this reciprocity is inherent to all physical quantities of space-time.

Space-time is a dynamic, elastic entity (elastic continuum = "ether") that can only expand or shrink in **quantitative leaps** when it is exchanged, but it never gets lost because it is closed. In reality, the *expansion* and *contraction* of space-time are the actual (visible) manifestations of energy exchange, which we perceive as motion. For instance, the contraction of photon space-

time is assessed as *gravitational attraction* at the material level (see chapter 4.8). This is the common view of humans, who are part of the material level. In mechanics, this exchange is assessed by velocity, which is the universal quantity of the primary term. Expansion and contraction are the only manifestations of motion that are assessed in thermodynamics (e.g. ideal gas laws, the definition of temperature etc.; see section 5.). At present, physics assesses energy statically as space or any other quantity relationship, e.g. as mass, time, or work. This is the reason why physicists have failed to develop an idea of space-time as a dynamic, elastic entity.

The concept of **matter** is such a static idea that has been developed in contrast to dynamic photon space-time. In the view of modern physics, electromagnetic waves represent structureless, massless energy, while matter implies mass and structure. Mass and matter are often used in the same connotation - Einstein's equation  $E = mc^2$  is a typical example of this semantic tautology. In order to abolish this energy-matter dualism (or wave-particle dualism) conclusively, we shall show that the mass (energy relationship) of all macroscopic objects can be obtained from the *mass of the basic photon  $h$*  within mathematics and only then confirmed in a secondary manner by empirical research. This new derivation will also bestow upon the Old Testament a new scientific touch.<sup>117</sup>

We begin with the basic SI unit for the *amount of substance* “**mole (mol)**“, where the term “substance“ is used as a synonym for “matter with mass“ (see essay under point 24.). A mole of any substance is defined as the amount of this substance that contains **Avogadro's number  $N_A$**  of atoms or molecules. We can regard the atoms or molecules of any substance as the action potentials  $E_A$  of this substance level  $E_{mol}$ , called “*mol-level*“, as they are considered to have a constant energy, respectively, mass. The energy of the system “1 *mol*“ can be expressed by the universal equation:  $E_{mol} = E_A N_A = E_A f$ . Thus Avogadro's number  $N_A$  is the time  $f$  of the *mol-level* of any substance  $N_A = f$ . In accordance with the new axiomatics, it is constant for all substances (systems) of the *mol-level*. The SI unit “1 *mol*“ is defined through  $N_A$ . It is an abstract category that is built according to the principle of circular argument and, as with all other units, it requires the arbitrary selection of a real system of reference. Avogadro's number is defined at present as the number of carbon atoms in 12 grams of  $^{12}\text{C}$ . The particular system “1 *mol*“ is a typical example of how one builds abstract levels or systems of space-time in physics. In this case, “1 *mol*“ is considered “1 *action potential*“ of the macroscopic substance system, which is an U-set of  $N_A$  atoms or molecules; the latter are action potentials of the corresponding microscopic level (U-subset) of matter. All these abstract levels are built within mathematics and contain energy space-time as an element.

---

<sup>117</sup> See Genesis, Moses' book 1, chapter 3: „*It will be light. And it was light*“.

It goes without saying that this kind of discriminating space-time or matter is an abstract achievement of human consciousness. As all thoughts are U-subsets of consciousness, the latter being equivalent to space-time, any abstract definition of system or level of space-time, has a corresponding correlate in the real world. Our knowledge of the outer world is thus an *a priori* property of the mind because human mind is part of space-time and therefore obeys the Universal Law. Kant speaks of *a priori* synthetic conclusions. The epistemological arrow of scientific knowledge departs from the mind and is only then confirmed in the external physical world, and not vice versa, as is believed in present-day scientific empiricism. In fact, this cognitive process is closed, just as space-time. At present, the empiric approach is prevailing in natural sciences, while the role of consciousness as an *a priori* source of knowledge is completely neglected. This is the origin of the cognitive misery of science at the turn of this millenium - it is cogent that this misery is self-inflicted.

As we see, the definition of “mole“ takes place within mathematics and results in a number -  $N_A$ . How can this abstract number be put in relation to matter (substance)? As usual, physics resorts to the vicious principle - a new unit of mass, the so called **atomic mass unit  $u$** , is introduced. It corresponds to 1/12 of the mass of one carbon atom  $^{12}\text{C}$ . The new axiomatics reveals that this circular definition employs  $N_A$  as a *conversion factor* and introduces the new unit of atomic mass  $u$  in relation to the standard unit of “1 kg“:

$$u = 10^{-3} \text{ kg}/N_A = 1.6606 \times 10^{-27} \text{ kg} \text{ or}$$

$$1u / 1\text{kg} = m_x/m_r = \text{SP}(A) = m = f = 1/10^3 N_A \quad (46)$$

From equation (46), we obtain the universal equation for the quantity “**molar mass**“:

$$m_x(\text{kg}) = 10^3 m_r N_A (\text{mols}) = E_A f \quad (46a)$$

Equation (46a) illustrates the “principle of similarity“ - the universal equation holds for space-time as well as for any quantity thereof. As mass is a space-time relationship, this principle is cogent from the presentation of this quantity. From equation (46a), we can calculate the *macroscopic molar mass of hydrogen  $M_H$*  from the mass of the basic photon  $h$  as a reference mass  $m_r = m_p$ . In this way we shall illustrate how one can obtain the mass of any macroscopic material object from the basic mass  $m_p$  of the “invisible“ photon level, which physicists conventionally perceive as empty, massless space. For didactic purposes, we shall only consider the mass of the proton  $m_{pr}$  and shall neglect the much smaller mass of the electron:

$$M_H = m_{pr} N_A = (m_p f_{c,pr}) N_A = 1.007 \times 10^{-3} \text{ kg/mol} (\cong 1\text{g/mol}) \quad (46b).$$

In equation (46b),  $f_{c,pr} = c/\lambda_{c,pr}$  is the **Compton frequency of proton** and  $\lambda_{c,pr} = 1.321410 \times 10^{15} m$  is the **Compton wavelength** of this particle. The latter is a known natural constant (see Table 1). We conclude:

It is possible to calculate the mass of any material object from the mass of the basic photon, that is, from the “mass of light“

We owe this “biblical“ achievement to the new axiomatics which eliminates religion as a cosmological concept of genesis (see volume IV). Its secret lies in the novel insight that space-time is a closed entity - we can always compare the space-time of any pair of systems or levels of space-time. Physics could be, indeed, as comprehensible as religion is to the layman, provided one approaches reality in a logical and deductive way. Both fields of intellectual endeavour do not need an interpreter, e.g. a priest or a specialist. Both can be substituted by mathematics - and mathematics by the new axiomatics, which is applied logic. Logical thinking itself is an *a priori* capacity of the mind and is thus accessible to everybody.

### 3.10 MECHANICS OF SOLIDS AND FLUIDS

We finish our survey of classical mechanics with a description of **solids** and **fluids** as systems or levels of matter, which is an U-subset of space-time. We begin with the basic quantity “**density**“. It is defined as a relationship of mass to volume (space):

$$\rho = \frac{m}{V} = \frac{K_s}{V} = \frac{SPA[2d - space]}{[3d - space]} = \frac{SP(A)}{[1d - space]} = \frac{SP(A)}{[3d - space]} \quad (47),$$

when  $[2d - space] = SP(A) = 1$  and  $m = SP(A)$ . Density is a very popular quantity of space-time in physics. For this reason, we have used it in the universal equation of gravitation (38b).

Solid objects are not as solid as their name would suggest: when subjected to forces (energy exchange), they tend to stretch, shear, or compress. Such interactions between solids give us an idea of an *elastic continuum* as already described by the *General continuum law*, which represents the simplest differential form of the Universal Law (see above). This effect is much more pronounced in fluids. The quantities with which such interactions are conventionally described can be easily derived from the primary term. The pleonasm of force, called **stretching** or **tensile force**, leads to the introduction of **tensile stress**:

$$\begin{aligned}\sigma &= \frac{F}{A} = \frac{SP(A)[1d - space - time]f}{[2d - space]} = \frac{SP(A)f^2}{[1d - space]} = \\ &= \frac{SP(A)}{[1d - space]} = \frac{m}{[1d - space]}\end{aligned}\quad (48)$$

We obtain for tensile stress the same expression as for density (47). This part of mechanics is highly iterative, therefore we shall skip it. However, it is of great practical importance. For further elaboration, see the exercises below.

*Exercises:*

1. Express *weight density*  $\rho g$  in the new space-time symbolism.
2. Express *strain* and *Young's modulus*  $Y$  in the new space-time symbolism.
3. Show that *pressure*  $P = F/A$  is a tautology of tensile stress.
4. Interpret *tensile stress* and *shear stress* in terms of reciprocal LRC.
5. Describe *bulk modulus*  $B$  and *compressibility*  $k$  within the new axiomatics.
6. Present *Archimedes's principle of buoyancy* by applying the axiom of reducibility. Describe the reciprocal character of *buoyant force* and *gravitational force* as LRC of two contiguous levels belonging to the system "fluid-object".
7. Describe *surface tension* and *capillarity* in the light of the new axiomatics. Prove that geometry is the method of definition and measurement of such quantities as *coefficient of surface tension* etc.
8. Show that the mental paradigm behind *Bernoulli's equation* of fluid motion is "**volume in motion**". Compare this paradigm with the definition of *charge* and *current* in electricity.
9. Confirm that *Venturi effect* "when the speed of a fluid increases, the pressure drops" and *superconductivity* are of the same mental origin - they are intuitive perceptions of the primary term (for further information see essay on superconductivity under chapter 6.9).
10. Explain *aerodynamics* in terms of the Universal Law. Imagine new energetic sources based on photon interactions, with which the present "engines of combustion" can be effectively replaced. Explain why the development of novel sources of photon energy is the only alternative to avoid the self-extinction of mankind (see also volume I, chapter 13.10, Fermi solution). Analyse the advantages of a new nanomolecular technology of artificial photosynthesis as an infinite source of energy. Envisage the stages of evolution of mankind to trans-galactic species.

## 4. WAVE THEORY

### 4.1 OSCILLATIONS

Mechanics is predominantly a study of statics and kinetics of solid material objects. At the same time it cannot neglect the objective existence of **oscillations** and **waves** that are propagated in solids, fluids and gases. This has led to the development of **wave theory** as a separate branch of classical mechanics that was further corroborated into electromagnetism and quantum mechanics. Oscillations and waves are a specific form of motion, which is the only manifestation of energy exchange. As in gravitational mechanics, velocity is the universal quantity of oscillations and waves. The latter can be regarded as distinct, *open* levels of energy exchange. As energy exchange is *closed*, all motions are *open rotations*. At the same time any rotation can be regarded as a source of waves or oscillations. From this we conclude that:

All motions in space-time are **superimposed rotations**.

This is a basic physical outlook of the new axiomatics that will facilitate our understanding of electromagnetism, quantum mechanics (see sections 6. and 7.) and the biological regulation of organic matter (see volume III). In a broader sense, the concept of space-time as an *entity of superimposed waves* will lead to the development of a new theory of *transcendental physics*, to which separate books will be dedicated. **Wave theory** consists of *harmonic synthesis* and *Fourier-analysis* (see chapter 4.4) which are based on integral and differential calculus. Thus mathematics is the method of definition and measurement in wave theory. This is an invariant motif in all physical disciplines.

As already mentioned, major disciplines, such as electromagnetism and quantum mechanics originate from wave theory. As wave theory is an integral part of classical mechanics, one would expect that these disciplines have been integrated into a coherent theory. However, present-day physics is far away from this goal. Nevertheless, wave theory, like thermodynamics, plays a central role in physics. As all motions of space-time are superimposed rotations, and any rotation can be regarded as a source of waves or oscillations, most phenomena of space-time can be presented by wave-theory. This fact is embodied in the well-known *wave-particle dualism* of quantum mechanics, where matter (space-time) is alternatively regarded as particles (stable spatial objects) and superimposed, dynamic waves.

The distinction between oscillations and waves is of formal character - wave particles are said to "oscillate" when they vibrate around a fixed point. When such oscillations are propagated in a medium, they are called waves.

The two terms, “oscillation“ (transversal motion) and “wave“ (longitudinal motion), are subjective descriptions of real rotations. Both terms assess periodical events that can be described in terms of action potentials (chapter 3.4). For this reason, wave theory is also basic to the presentation of the new term “action potential“ (chapter 4.6).

In this survey, we shall first introduce the traditional line of argumentation of wave theory and then interpret it in the light of the new axiomatics. We begin with the definition of oscillation: “Oscillation occurs when a system is disturbed from a position of stable equilibrium“<sup>118</sup>. This definition is based on the notion of equilibrium - it is a circumlocution of Newton’s second law (see chapter 3.3). Each oscillation results in a *restoring force* that can be described by the universal equation as proven for Hooke’s law and the General continuum law (chapter 3.2). “The most recognizable characteristic of oscillatory motion is that the motion is *periodic*, that is, it repeats itself.“<sup>119</sup> Wave theory acknowledges the fundamental feature of space-time, namely, its discrete character (point 5.) - energy exchange occurs through oscillations or waves, that is, energy is transmitted by constant energy packages that repeat themselves. We call such constant energy events “action potentials“. They are central to the epistemological background of the new axiomatics.

The basic method of wave theory is the **sine-cosine function**, which is another mathematical expression of the probability set. This function is the method of definition and measurement of **simple harmonic motion**; it is an idealisation of real rotation - the source of simple harmonic motion is *circular* motion. Such motions can be described with Hooke’s law that is an application of the Universal Law.

A common quantity of oscillations is **frequency**. It is a particular quantity of time  $f$ . The SI unit of frequency is “1 *hertz*“, which is a synonym for “1 *action potential*“. In this case, the event “1 second“ occurs once per unit conventional time  $t = 1 s$  :

$$1 \text{ oscillation} = 1 E_A = 1 \text{ hertz} = 1s / 1 s = SP(A) = \text{certain event} = 1 \quad (49)$$

Wave theory acknowledges the fact that space-time has only two dimensions: the other quantity of importance is the **amplitude A** of an oscillation. It is defined as [1d-space]-quantity by the cosine function with respect to the “0“-point of the co-ordinate system:

$$x = A \cos\left(\omega t + \frac{3\pi}{2}\right) = A \sin \omega t = [1d - space] SP(A) \frac{f}{f} = SP(A) [1d - space] \quad (50)$$

---

<sup>118</sup> PA Tipler, p. 368

<sup>119</sup> PA Tipler, p. 368

The sine-cosine function describes the space-time of rotations as a function of the amplitude - it is a magnitude of the maximal extent (distance) of an oscillation:  $A = [1d\text{-space}]_{\max}$ . The quantity  $\omega$  in (50) is called **angular frequency** and is a pleonasm of *angular velocity* (17).

Wave theory produces a number of quantities, which are tautologies of those introduced in mechanics of rotations (see chapter 3.4). Some definitions appear to be cognitive blunders when analysed in the new axiomatics: for instance, the angular frequency is erroneously regarded as time  $f$ , while  $\pi$  is considered a number and not a space-relationship. The distance  $x$  in equation (50) is a  $[1d\text{-space}]$ -quantity measured with respect to  $A$  (principle of circular argument) - hence the use of  $SP(A)$  for the sine-cosine function. The values of  $x$  "oscillate" between 1, 0, and -1. This mathematical-geometric function reflects the dynamic character of energy exchange as applied to its constituent *space*. The values of the continuous sine-cosine function build the probability set  $0 \leq SP(A) \leq 1$ . Its mirror image (0,-1) is a pure convention, but it already anticipates the reciprocal character of space and time. The sine-cosine function is a mathematical iteration of the continuum  $n = SP(A)$ . It illustrates the only possible method of acquiring the "certain event", namely, by comparing the space-time of a (rotating) system or a quantity thereof (space  $x$ ) with itself, e.g. with the amplitude  $A$ :  $x_{\max}/A = 1$  (see also the definition of the SI unit *hertz* above). We shall show that the same mathematical approach leads to the definition of charge as a *cross-sectional area* of a wave or a particle (chapter 6.2).

*Simple harmonic motion* is regarded as a product of circular motion. The **energy** of this ideal rotation is assessed by Hooke's law:

$$\begin{aligned} E_{total} = U + E_{kin} &= \frac{1}{2} kx^2 + \frac{1}{2} mV^2 = \frac{1}{2} kx^2 = SP(A) f^2 SP(A) [2d - space] = \\ &= SP(A) [2d\text{-space-time}] = E \end{aligned} \quad (51)$$

We obtain the universal equation for the energy of simple harmonic motion. As in classical mechanics, energy is subdivided in an abstract way into **potential energy** ( $LRC = U$ ) and **kinetic energy** ( $E_{kin} = E$ ). The **total energy**  $E_{total}$  is the sum of the two abstract U-subsets. This is a circumlocution of energy conservation due to the closed character of space-time. In the new axiomatics, we subsume this knowledge of the primary term under the axiom of conservation of action potentials (point 34.): when  $E_{kin} = E_{A1}$  and  $E_{pot} = LRC = U = E_{A2}$ , then  $E_{A1} = E_{A2}$ . When  $E_{A1}$  is completely transformed in  $E_{A2}$ , we can assign the former the number "0". In the theory of probabilities, this will be the "improbable event":  $SP(A) = 0$ . In physics, this formal procedure is circumscribed as follows: „When the displacement is maximum  $x = A$ , the velocity is zero

( $E_{kin} = 0$ ), and the total energy is:  $E_{total} = 1/2kA^2 = E_{A2} = SP(A) = 1^{120}$ . The force constant  $k$  in equation (51) is a number:  $SP(A)f^2 = SP(A)$  (see equation (7)). In this case, the total energy of a simple harmonic motion is proportional to the **square amplitude A**:

$$E_{total} = 1/2kA^2 = SP(A)f^2 [2d-space] = SP(A)[2d-space] = K_s \quad (52),$$

$$\text{when } f = SP(A) = 1$$

Equation (52) illustrates the classical method of mathematics, with which energy (space-time)  $E$  is reduced to space and described in terms of area or structural complexity  $K_s$ . It is to this simple procedure that we owe the definition of *charge Q* as area:  $Q = K_s = SP(A) \times A^2 = \text{area}$  (see chapter 6.2). The presentation of waves (oscillations) as energy  $E$  (51) or structural complexity  $K_s$  (52) is the vested prototype behind all basic definitions and laws of electricity, magnetism, electromagnetism and quantum mechanics.

However, simple harmonic motion does not exist. It is an abstraction of our mathematical consciousness. This interaction is of the same paradigmatic character as “elastic collision“, or “closed conservative system“. Such ideas are N-subsets of consciousness that perceive the closed character of the primary term, but erroneously contribute this property to its open parts. The use of such concepts viciates the physical outlook of nature and leads to fundamental inconsistencies and paradoxies. This precludes the development of a unified theory of physics. In reality, all oscillations are **damped**, that is, they are **dissipative**. Consider now damping of oscillations as a *drag force*  $F_d = -bv$ , where  $b = SP(A)f = mf$  is defined as a *constant* that describes the *amount of damping*. In fact, it is a mass quantity, that is, it is a space-time relationship  $m_b = mf$  (see chapters 3.8 and 3.9). The decrease of energy in damped oscillations is expressed with **exponential integrals** of the kind:

$$E = E_o e^{-(b/m)t} = E_o e^{-t/\tau} \quad (53),$$

where  $\tau$  is the **time constant**:

$$\tau = \frac{m}{b} = \frac{m}{m_b} = \frac{SP(A)}{SP(A)_b} = SP(A) = f \quad (53a)$$

Exponential integrals are mathematical iterations of the primary axiom that allow an infinite increase in mathematical complexity (points 2. & 25. and equation (25-4)):

---

<sup>120</sup> PA Tipler, p. 377

$$\frac{E}{E_0 e^{-(b/m)t}} = 1 = \text{primary term} \quad (53b)$$

Equation (53b) confirms that we can add infinite quantities of the primary term to a mathematical equation without affecting the principle of last equivalence (point 2.). This equivalence is the origin of all mathematical operations and equations, including exponential calculus. The time constant is a quantity of time  $\tau = f$ . This quantity determines the constant duration of each damped oscillation. We can regard an oscillation as a **standing wave** (see chapter 4.4) that can be described as a particle (wave-particle dualism). In this case, the *time constant* determines the lifetime of any system perceived as a structural complexity. From this we realize why exponential functions are frequently used in quantum physics for describing the finite lifetimes of particles, for instance, in *radioactive decay*.

When damped oscillations are *driven*, they behave like simple harmonic motion. **Driven oscillations** are open rotational systems. Recall: all gravitational systems, such as solar systems, are open rotational systems (Kepler's laws). Each system has a *natural frequency*, called **resonance frequency**:  $\omega = \sqrt{k/m} = \sqrt{SP(A)f^2/SP(A)} = f$  (see equation (53)). This term implies that each system has a *specific, constant absolute time*  $f$  (= *resonance frequency*) that determines its space-time and duration  $t = 1/f$ . Only when energy exchange occurs in a state of total harmony (**resonance of frequencies**) between the individual systems and levels, do we have an optimal energy exchange leading to spatial stability of structures. This aspect is intuitively covered by the **factor of damping Q**:  $Q = \omega_0/\omega = f_0/\Delta f = f = SP(A)$ .

The mathematical problem of determining the optimal conditions of energy exchange is to find  $Q$ , for which the maximal stability of forms is obtained. This is the eschatology of mathematics in the evolution of mankind - all natural sciences emerge as applications of mathematics for concrete levels of space-time, e.g. economics for the level of society, medicine and bio-sciences for the levels of cells and organisms (see volume III) etc. The only objective of these sciences is to maintain harmony in the systems and levels created by man and prolong the lifetime of their structures<sup>121</sup>.

The stability of systems and levels is a result of the evolution of space-time (see Evolution Law in point 50.). This idea is also basic to Fourier-analysis and harmonic synthesis (see chapter 4.4) and has already been anticipated by *Leibniz*, the last universal genius of modern times. In his *monadology*,

---

<sup>121</sup> This aspect is further developed in the **New Gnosis** of the Universal Law, where human psyche and emotions are discussed in terms of harmony and disharmony. Especially, the role of anguish (angst) in human behaviour is highlighted there.

he describes the physical world as a “preestablished harmony of infinite monades” (systems and levels of space-time). Each monade has a specific structural complexity and is, at the same time, a “mirror image” of the universe (U-subsets that manifest the nature of space-time, hence the ubiquitous validity of the Universal Law). The preservation of this fragile, dynamic order of spatial structures determines the eschatology of science and mathematics.

*Exercises:*

1. Express the formula of the *period of simple harmonic motion* as exhibited by a mass on a spring  $T = 2\pi\sqrt{\frac{m}{k}}$  in the new space-time symbolism. Prove that it is identical to the formula of the period of motion of a *simple pendulum*  $T = 2\pi\sqrt{\frac{L}{g}}$ , where  $L$  is the length of the pendulum. Confirm that both equations are obtained from the universal equation by applying Hooke’s law and Newton’s second law. Show the same for the period of a *physical pendulum* and a *torsional pendulum*.
2. Write the kinetic and potential energy of simple harmonic action as sine-cosine function and express the formulae in the new space-time symbolism.
3. Show that the **quality factor**  $Q = 2\pi E / |\Delta E|$  of damped oscillations, where  $|\Delta E|$  is the energy loss in one period, is a quantity of time  $f = E/E_A$ . Prove that the *Q factor of the sharpness of resonance*  $Q = f_o/\Delta f$  is equivalent to the quality factor. Discuss the idea of “*steady-state solution*” with respect to these quantities.
4. Explain  $Q$  in *Mössbauer effect* in the light of the new axiomatics. Discuss why this effect may be an appropriate method of measuring gravitational energy exchange between photon level and matter (measurement of relativistic changes) as presented in chapter 4.8.

## 4.2 CHAOS THEORY

The perception of nature as an inner harmony that evolves from a “creative chaos” is not only paradigmatic to Genesis, but also to modern **Chaos theory**. This emotional revolt against “established physics” distinguishes between “disorder” (chaos) and “order” without making any efforts to define in an irrevocable manner what these terms really mean. This flaw discredits Chaos Theory as an intellectual achievement. Although the law of entropy is paradoxical to the basic concepts of Chaos Theory, this recent aberration of

scientific thinking has failed to reject the wrong notion of increasing entropy in the universe. This is another serious flaw of Chaos theory. The second law of thermodynamics will be rejected for the first time in the new axiomatics (chapters 5.6 & 5.7).

However, Chaos Theory has developed a number of partial ideas that stimulate an understanding of the new axiomatics. One of them is the famous *Feigenbaum's scenario* or *cascade*, with which *phase transitions* are described as constant numbers. These are absolute constants of vertical energy exchange ( $K_{1,2}$ ), that is, they are constant relationships of space and time of contiguous levels of space-time. These constants are of the same character as the damping factor  $Q$  of resonance.

The most important aspect of Chaos theory is the practical simulation of chaos and order in computers. By employing recurring algorithms containing transcendental numbers, it is possible to create a "virtual reality" as a product of pure numbers. This gives us an idea why space-time is equivalent to the continuum, or more precisely, to the continuum of transcendental numbers, and why it can be adequately described in a mathematical input-output model composed of absolute constants of energy exchange (see chapter 9.9).

#### 4.3 MECHANICAL WAVES

**Mechanical waves** are oscillations of mass particles that are propagated in a *medium*. The medium is a system of matter that is usually described as "elastic". This aspect of matter has given rise to the concept of ether. The paradoxical approach to matter and photon space-time in conventional physics is testified by the following quotation:

„In mechanical waves, such as waves on a string or sound waves in air, the energy and momentum are transported by means of a *disturbance in the medium*... the disturbance is propagated because of the elastic properties of the medium. On the other hand, in electromagnetic waves (such as light, radio, television, or x rays) the energy and momentum are carried by *electric and magnetic fields* that can be propagated through vacuum.“<sup>122</sup>

However, we never learn from traditional physics how electromagnetic fields are propagated through vacuum (see Born's remark above). The vicious character of this view should be therefore cogent to everybody; it has also hindered an understanding of gravitation.

With respect to form, waves are subdivided into **transverse** and **longitudinal** waves. We have already discussed this formal approach in conjunction

---

<sup>122</sup> PA Tipler, p. 409

with the two terms “oscillation“ and “wave“. The basic quantity of waves is velocity as one-dimensional space-time. There are various mathematical ways of expressing this universal quantity of energy exchange. A common formula is the building of a quotient according to the principle of circular argument between the *force*  $F$  and the **mass per unit length**  $\mu = m/\Delta s = SP(A)/[1d\text{-space}]$ ; the latter quantity is a pleonasm of *mass density* (47):

$$v = \sqrt{\frac{F}{\mu}} = \sqrt{\frac{SP(A)[1d\text{-space-time}]f[1d\text{-space}]}{SP(A)}} = [1d\text{-space-time}] \quad (54)$$

Equation (54) is another iteration of velocity within mathematics. From it the classical wave function is derived (see chapter 4.5).

The evaluation of harmonic waves leads to the introduction of further quantities (see also chapter 3.4). The distance between two successive *wave crests* is called **wavelength**  $\lambda = [1d\text{-space}]$ . It is a constant for each system. For instance, the wave-length of a selected electromagnetic wave (system of photon space-time) that is emitted by caesium atoms is the original real reference system of the SI unit, 1 *meter*, which is an anthropocentric surrogate. When this  $[1d\text{-space}]$ -quantity is set in relation to  $2\pi$ , which is another  $[1d\text{-space}]$ -quantity, we obtain a new quantity, called the **wave number**  $k$ , which is a pure number, but is inconsistently expressed as reciprocal  $[1d\text{-space}]$ -quantity because  $\pi$  is erroneously considered a number and not a  $[1d\text{-space}]$ -quantity:

$$k = 2\pi/\lambda = SP(A) \quad (55)$$

This quantity plays a central role in the presentation of *standing waves* (chapter 4.4). The primary term is considered in wave theory, insofar as this branch of physics cannot neglect the ample evidence that waves transmit energy. The equations that are derived for the energy of waves illustrate the infinite potential of mathematics in defining new quantities of the primary term which are U-subsets thereof and abide by the primary axiom (see also the use of exponential integrals in equations (53) to (53b)):

$$\Delta E = \frac{1}{2} \mu \omega^2 A^2 \Delta x = SP(A)[2d\text{-space-time}] \quad (56)$$

$$P = \frac{\Delta E}{dt} = \frac{1}{2} \mu \omega^2 A^2 v = SP(A)[2d\text{-space-time}] \quad (57),$$

when  $P = E = E_A$

Wave theory acknowledges that waves are open U-subsets of space-time, which contain themselves as an element - it defines the **superposition** of harmonic waves as **interference**. "Superposition" and "interference" are synonyms. **Resonance** is another word for interference. Each superimposed wave can be regarded as a superimposed rotation. The *principle of superposition* of electromagnetism reflects the open character of the systems. It says that all charges (areas) in the universe interact with each other - if their number could be determined, their electromagnetic interactions would be precisely described with Maxwell's equations. In fact, all that this principle means, is that all systems and levels of space-time are open U-sets and exchange energy. The mathematical elaboration of interference departs from the sine-cosine function  $y = A\sin(kx - \omega t)$  (method of definition and measurement) and is open-ended with respect to complexity.

Essentially, there are two forms of interference, with which the boundary conditions of energy exchange are assessed: **constructive** and **destructive interference**. If the *phase difference*  $\delta$  is zero, that is, if the waves are "in phase", the resultant wave has an amplitude twice that of either wave. This is the mathematical condition for constructive interference:  $y^1 + y^2 = 2A \sin(kx - \omega t)$ ,  $\delta = 0$ . When the phase difference is  $\delta = \pi \text{rad} = 180^\circ$ , the waves are "out of phase":  $y^1 + y^2 = A \sin(kx - \omega t) - A \sin(kx - \omega t) = 0$ . This is the mathematical condition for destructive interference. We may also say that this is the condition under which structural complexity *dissipates* or space "disappears". The space of the resultant system from the interference (interaction) of two waves with a given amplitude (axiom of reducibility) dissipates during destructive interference in the space-time of the underlying systems. We can describe constructive interference as "harmony" or "order" and destructive interference as "disharmony" or "disorder" (chaos). These terms are of precise mathematical character. They are consistent with the basic axioms of our axiomatics.

Departing from *de Broglie's* outlook of the wave character of matter as proven for the macro- and microcosm, we come to the conclusion that the conditions for creation and dissipation of space-time structures can be mathematically determined (see chapters 4.1 & 4.2). This holds in waves, e.g. in standing waves (see chapter 4.4), in materials subjected to vibrations, in equity charts, in macroeconomics (e.g. monetarism and keynesianism as methods of avoiding economic crises) and so on. We can predict the creation and dissipation of any structural complexity, including social structures, by employing mathematics and finding the conditions of constructive and destructive interference of each particular level or system. Precisely this should be the role of mathematics in human activities - this hermeneutic system of logical thinking is the only adequate perception of space-time. However, mankind is light years away from the mental state of logical thinking at the individual and collective level. The incessant wars and economic crises in the last two thousand years of written history are a compelling evidence for this irrefutable conclusion.

Therefore, the extinction of human species is quite probable, unless there is a dramatic change of thinking in the next few years.

Although **acoustics** is a separate branch of physics that deals with **sound**, sound waves are, in fact, mechanical waves. Everything we have already said about mechanical waves, also holds in the case of sound. Major aspects of acoustics, such as *standing sound waves* and *interference*, are covered in the next chapter. Some specific formulae of acoustics are discussed in the exercises below.

*Exercises:*

1. Show that the formula for wave velocity  $v = \sqrt{\frac{\sigma}{\rho}}$  (1), where  $\sigma$  is *tensile stress* (48) and  $\rho$  is *density* (47), is equivalent to equation (54). Prove that the formula for the speed of sound  $v = \sqrt{\frac{B}{\rho}} = \sqrt{\frac{\gamma RT}{M}}$  (2), where  $B$  is *bulk modulus*,  $R$  is *universal gas constant*,  $M$  is molar mass of gas and  $T$  is temperature in *kelvins*, is equivalent to equation (1). Discuss the dimensionality of these quantities with respect to the primary term. Establish the link between wave theory and thermodynamics (see thermodynamics below).
2. Determine the dimensionality of the **phase constant  $\delta$** . Prove that it is a transcendental number belonging to  $SP(A) = n$ . Discuss the interference of sound waves with respect to this constant.
3. Establish the dimensionality of the quantity, **intensity of waves**  $I = P_{av} / A$ . Show that geometry (presentation in three dimensions) is the method of definition and measurement of this quantity. Prove that this quantity can be directly derived from the General continuum law. Discuss the similar ontological background of the intensity of waves and Einstein's cosmological constant (exercise 2, chapter 3.7).
4. Express **intensity level  $\beta$  of loudness** as measured in *decibels* with the universal equation given as a rule of three (equation (36-1)). Establish the origin of *logarithms* from the primary term. Show the transitivity of this operation with respect to other mathematical operations.

#### 4.4 STANDING WAVES AND QUANTUM MECHANICS

When waves are confined in space like waves on a guitar string there are reflections at both ends so that the waves are travelling in both directions. Under the condition of constructive interference a stationary vibration pattern occurs, called a **standing wave**. It is described in terms of a *fundamental* mode of vibration (first harmonic), second, or  $n$ th-harmonic, which are circumlocutions for the number of action potentials:  $f = n$ . The point of maximal amplitude is called *antinode* ( $A = [1d\text{-space}]_{\max}$ ) and the midpoint - *node* ( $x = [1d\text{-space}]_{\min}$ ). This is pure geometry applied to the physical world. The space confinement of the string at both ends embodies the closed character of space-time. The **standing wave condition** is usually defined for the space, for instance, for the *length of the string*:

$$l = n \frac{\lambda_n}{2}, \text{ when } n = f = 1, 2, 3, \dots \quad (58)$$

The length of the string can be regarded as the circumference of a circle  $l = C$ . From equation (58) one can find the frequency of the  $n$ th harmonic:

$$f_n = n \frac{v}{2l} = \frac{1}{2l} \sqrt{\frac{F}{\mu}} = nf_1 = ff_1 = f^n = SP(A) \quad (59)$$

Equation (59) reveals that standing waves are U-subsets that contain themselves as an element. Each standing wave can be regarded as the aggregated product of superimposed waves. According to the axiom of reducibility, it can be expressed as the resultant wave of two interacting waves  $f = f_1 f_2$ . The frequency of a standing wave is a function of the driving force  $F$  and the mass (space-time relationship)  $\mu$  of the system. This confirms that standing waves are propagating energy. In this case, the *first harmonic* or *fundamental* can be regarded as the *elementary action potential* of the vibrating system. Standing waves can be counted. The same is true for the action potentials:  $n = f$ . Wave theory uses only integers to count  $n$ th-harmonics. This approach reflects the preferential use of integers in mathematics and in calculation. In reality,  $f = SP(A) = n$  is always a transcendental number<sup>123</sup>. This becomes evident when we consider  $l$  as a circumference  $C$ . We can measure the latter only when we use the transcendental number  $pi$ .

---

<sup>123</sup> For instance, the KAM-theorem which assesses the conditions of order in the universe renders transcendental numbers as solutions when applied to real events (for further reading see German volume I, chapter 13.9).

A standing wave is thus an U-subset of space-time that manifests the properties of the whole. In this sense, if we consider space-time as a closed entity that is confined to itself, we can regard it as the **total set of all superimposed waves** (U-subsets), which are rotating in both directions. They build various standing waves that are distinct systems or levels of space-time. Such standing waves are conventionally called elementary particles, atoms, molecules, macroscopic matter, solar systems, galaxies and so on.

We have proved that all motions in space-time are superimposed rotations because of the closed character of space-time and the open character of its U-subsets. Linear translation of waves is thus a pure abstraction born in the realm of geometry. On the other hand, we learn from wave theory that any *real* rotation is a source of waves.

In electromagnetism, photon space-time is described in terms of electromagnetic waves that are rotating. On many occasions (e.g. in QED), electromagnetic waves are regarded as particles - one speaks of standing waves or **wave packets** (chapter 4.6) - that propagate energy in the form of action potentials throughout space with the constant speed of  $c$ . This approach is basic to Planck's equation,  $E = hf = hc/\lambda = E_A f$ , with which the *ultraviolet catastrophe* in **Rayleigh-Jeans law** has been eliminated. Quantum mechanics describes all elementary particles by giving their **spin** or **angular momentum**, which are quantities of rotation.

Indeed, equation (59) tells us that the term "standing wave" implicates the propagation of discrete energy amounts with the velocity  $v$  that is specific for each vibrating system. The term "standing" is thus restricted to the visual form. In reality, all particles of a vibrating system that build a standing wave are in incessant motion. The General continuum law (chapter 3.2.) and the classical wave equation (chapter 4.5) cover this issue. From this simple introduction we can conclude that:

The term "**particle**" is a circumlocution for the **standing wave condition** (*constructive interference*) that allows the building of standing waves or wave packets (chapter 4.6) of varying form, space, time and velocity.

This conclusion affects a great simplification in our physical outlook, especially in quantum mechanics. For instance, de Broglie interprets **Bohr's quantization condition** for the *angular momentum* (24)  $L = mvr = E_A = nh/2\pi$  of the electron of the hydrogen atom as a "**standing photon wave in rotation**" (Bohr's 3rd postulate, see chapter 7.1). In this case, the momentum  $mv$  is substituted with the term  $h/\lambda$ :

$$mv = h/\lambda = SP(A)[1d-space-time][1d-space]/[1d-space] = SP(A)[1d-space],$$

to obtain the circumference of **Bohr orbit** (electron orbit)  $C = l = n\lambda = 2\pi r$ . The photon wave that rotates along this circumference can be a standing wave, called “electron“, only if it complies with the standing wave condition in equation (58):  $C = n\lambda/2 = \pi r$ . In fact, this conventional approach of Bohr and de Broglie is a hidden definition of the axiom of conservation of action potentials:  $E_{A,electrons} = m_e c \lambda_{c,e} = h = m_p c \lambda_A$  (see equation (45a)). With this equation, we can find the exact wave frequency of constructive interference of the electron that allows its existence as a **standing wave in rotation**. In the view of wave-particle dualism, this condition is considered a “particle“:

$$f = \frac{c}{\lambda} = n \frac{c}{2C} = f_n \frac{[1d - space - time]}{2[1d - space]} = f_n f_c \quad (60)$$

According to equation (60), the frequency of the electron wave can be expressed as a resultant frequency of two superimposed waves (axiom of reducibility). A full elaboration of Bohr model of hydrogen atom is given in chapter 7.1. The objective of this survey is to establish links between wave theory and quantum mechanics, that is, to demonstrate that quantum mechanics is applied wave theory to the microcosm.

Much of wave theory is dedicated to wave forms. When they are analysed with respect to the harmonics that comprise them, this is called **harmonic analysis** or **Fourier analysis** (to be compared with mathematical analysis, e.g. with differential calculus). The inverse of harmonic analysis is called **harmonic synthesis** (to be compared with integral calculus). Both branches introduce mathematics as the only method of definition and measurement in wave theory. Their origin is the primary term - such mathematical operations adequately reflect the inhomogeneous character of space-time as the total set of all U-subsets - in this particular case, as superimposed rotations that contain themselves as an element.

*Exercises:*

1. Express *standing sound waves* within the new axiomatics.
2. Discuss *reflection, refraction and diffraction* in the light of the Universal Law.

#### 4.5 WAVE EQUATION

The general wave function  $y(x, t)$  is a solution of a differential equation, called **wave function**. This equation can be derived from the *General continuum law*, which is a differential equation of the Universal Law. We have already shown that Newton's laws and Hooke's law are partial solutions of the General continuum law (chapter 3.2). In this chapter, we shall prove that the **classical wave function** is another application of the Universal Law. As the wave function is also basic to *Schrödinger wave equation* of quantum mechanics, we shall actually prove that both macrocosm and microcosm are adequately described with the universal equation.

The derivation of the wave function departs from the notion that all particles participating in a wave perform a rotation that approximates *circular motion*. This motion is then described by Newton's laws. Equation (54) gives the method of derivation, which results in the following differential equation:

$$\frac{\partial^2 y}{\partial x^2} = \frac{\mu}{F} \frac{\partial^2 y}{\partial t^2} = \frac{1}{v^2} \frac{\partial^2 y}{\partial t^2} = \frac{1}{[2d - space - time]} \frac{\partial^2 y}{\partial t^2} = \frac{1}{LRC} \frac{\partial^2 y}{\partial t^2} \quad (61),$$

where  $x, y = [1d-space]$  and  $t = 1/f$ ;  $y$  is the amplitude and  $x$  is the segment length in the direction of the wave length. Equation (61) is the differential form of the **wave equation**. If we solve for the long-range correlation, LRC, we acquire the universal equation of space-time (see point 43.):

$$LRC = \frac{\partial x^2}{\partial t^2} = \partial x^2 \partial f^2 = SP(A) [2d - space - time] = [2d - space - time].$$

(61a),

when  $\partial = SP(A) = 1$ . The wave function demonstrates that the universal equation is the origin of all mathematical operations - in this particular case, of differential calculus. This helps us to understand Nabla- and Laplace-operators (chapter 6.6.) that are basic to Maxwell's equations (see chapter 6.13).

In this chapter, we have proved that the classical wave function is a concrete application of the universal equation. In the next chapter, we shall show that each wave or oscillation can be presented as an action potential  $E_A$ . Thus we shall ultimately prove the **wave character** of space-time.

#### 4.6 THE ACTION POTENTIAL AS A WAVE

Regardless of the actual form, each **action potential** can be described as a **wave**. According to wave-particle dualism in physics, it can be visualized as an oscillation that repeats itself, for example, as a wave that moves along a string, or as a standing wave. Both moving and standing waves are assessed as events in motion and described by the velocity (54) or the long-range correlation  $LRC = v^2$  (equation (61a)). As space-time has only two constituents, space and time, a wave is usually described by these quantities. For instance, the wave equation (61) is a differential function  $y$  with respect to space (wavelength)  $x = [1d\text{-space}]$  and time (frequency)  $f = 1/t$ .

The basic property of the action potential is its *constant* space-time (energy). The amount of energy is specific for each system or level. This constancy also holds in space and time - the wavelength and frequency of each real system of space-time are constant. For example, *Compton wavelength* and *frequency* of the elementary particles, electron, proton and neutron, are well known natural constants that can be experimentally measured (see Table 1). The *resonance frequency* assesses this fundamental fact for each specific material system.

Consider now a standing wave on a string: the *first harmonic* which we call the **elementary action potential** of the system has the same amplitude  $A$  as the *n*-th-harmonic of the standing wave, that is, the amplitude is independent of the actual frequency. This is a well known fact in wave-theory which everybody can demonstrate for himself. Note: In this case, we can arbitrarily regard each *n*-th-harmonic as a distinct system with a specific constant frequency and form, although it occurs on the same string.

The total energy of a simple harmonic wave depends only on the *square amplitude*  $A$ :  $E_{total} = 1/2kA^2 = SP(A)[2d\text{-space-time}]$  (51), because the *force constant*  $k$  from Hooke's law is specific for each system and describes the elasticity of the material. In the new axiomatics,  $k$  is square time  $k = SP(A)f^2 = f^2$ . It assesses the specific time of the system as a resultant quantity of two superimposed waves (axiom of reducibility).

The formula for the total energy of a simple harmonic wave (52) proves the axiomatic definition of the constant space-time of the action potential. As space-time of waves is assessed in terms of wavelength and frequency, these quantities are also found to be constant for each system (source and medium). The same is true for the velocity - it is a specific constant for each medium (system). When the force constant  $k$  is expressed as a closed number that belongs to the continuum  $k = SP(A) = n$ , the universal equation of a wave energy is presented as *structural complexity*:

$$E_{total} = SP(A)[2d\text{-space-time}] = 1/2kA^2 = SP(A)[2d\text{-space}] = K_s \quad (63)$$

Within mathematics, we can voluntarily set the term  $1/2k = SP(A)f^2 = 1$  for the certain event or 1 *unit*. We find that the **total energy** of a reference wave that is regarded as an action potential is equivalent to the **square amplitude**  $A^2$ :

$$E_{total} = K_s = A^2 \quad (63a)$$

This is a very useful equation that demonstrates how the *elementary charge* of the *electron* is defined within mathematical formalism. Departing from the idea that this particle is a standing rotational wave (Bohr model)<sup>124</sup>, the electron is presented by its square amplitude  $A^2$  as structural complexity  $K_s$ . This two-dimensional space quantity is then regarded as a *reference system of area* and called “elementary charge“. In electricity, the area  $A^2$  is usually presented as a **cross section to the direction of motion** of particles. The area  $A^2$  of all other particles, also considered as rotational waves, is then compared to this elementary reference area. For instance, the antinode of a standing wave on a string can be presented as a cross section (square amplitude  $A^2$ ), while a standing wave in rotation, which is visualized as a sphere, is alternatively given as a disc or area of hemisphere. The latter geometric approach has been unconsciously used in the presentation of the electron (see chapter 6.2 and Coulomb’s law).

Thus physics is to a large extent applied geometry - this is the hidden definition of this “empiric discipline.“ Considering the fact that the kind of geometry generally employed in present-day physics has already been developed in the antiquity, it is hardly to perceive what additional empirical knowledge modern physics has furnished in the following twenty five centuries. Today, we do not know more about nature than ancient Greeks. This historical irony will undoubtedly undermine the high esteem this science cherishes today. However, geometry is an idealization of the real world - all geometric forms are defined by exact equivalences of abstract character. For instance, the circle is defined as the line that displays the same distance from a point, called a “centre“, to any point of the line, called “circumference“. In reality, all equivalences which we define are mathematical approximations - they are abstract definitions of the mind based on the primary idea of closed real numbers, e.g. SI system. As mathematics has not yet developed an adequate method of using transcendental numbers, we also resort to closed real numbers in this book. However, the only correct perception of space-time is the use of transcendental numbers. It is very important not to forget this fact.

---

<sup>124</sup> The charge of the electron was initially defined as area in classical electricity, through the definition of current. This hidden definition was then set forward in Bohr model by employing wave theory.

A classical example of an action potential in wave theory is the **wave packet**. The presentation of this energetic event demonstrates the use of the closed real number “1” as the ubiquitous symbol of the primary term or a subset thereof. The wave packet is a pulse consisting of a group of waves of different frequencies that has a beginning and an end, whereas a harmonic waves repeats again and again. When the range of the angular frequencies  $\Delta\omega$  is very large  $\Delta\omega \rightarrow \infty$ , the duration of the pulse is very short  $\Delta t \rightarrow 0$ . In wave theory, the general relation between these two quantities of the wave packet is set equivalent to the number “1”:

$$\Delta\omega\Delta t = 1 \quad (64)$$

This equation merely reflects the reciprocal character of space and time:  $\Delta\omega = 1/\Delta t = f$ . As already mentioned, although the angular frequency  $\omega$  has the dimensionality of  $v$ , it is conventionally expressed as frequency. This is an inconsistency of mathematical presentation in physics. The reciprocity of the two constituents becomes evident when the *wave number*  $k$  is introduced:  $\Delta k = \Delta\omega/v = 1/[1d\text{-space}]$  (55). Equation (64) can then be rearranged as follows:

$$v\Delta k\Delta t = \Delta k\Delta x = [1d\text{-space-time}] / [1d\text{-space}] f = 1 \quad (65)$$

This formula illustrates the principal way of building mathematical equations. One can introduce an infinite number of quantities of space-time as U-subsets and set them equivalent to the universal mathematical symbol “1” of the primary term according to the principle of last equivalence. In addition, our mathematical consciousness has the degree of freedom to attribute this number to any subset of space-time, for instance, to an action potential or a system as 1 *unit* or the certain event. From this, we follow:

The number “1” is the **universal symbol used for the building of all mathematical equations**, independently of the kind of the operations employed.

This must be, indeed, an incredible simplification for anybody who has always had difficulties in comprehending mathematics, but, to quote Woody Allen, “did not dare to ask about the reason“. This applies in the first place to professional mathematicians, who operate with numbers and equations, but do not understand their deeper logic<sup>125</sup>. It goes without saying that this also holds for physicists, although they are seldom good mathematicians. For example, Schrödinger used the same procedure to establish his wave equation of quan-

---

<sup>125</sup> This aspect has been brilliantly covered by my friend G. Schischkoff (+1989), editor of the German Philosophical Dictionary, in his doctor thesis “Gegenwärtige philosophische Probleme der Mathematik“, Dr. Georg Lüttke Verlag, Berlin, 1944.

tum mechanics. In the **standardization condition** (*Normierungsbedingung*) of his wave function  $\psi$ , the **probability density** of the particle is statically regarded as an *area integral*, that is, as  $K_s$ , and is set equivalent to the number “1” in an *a priori* manner without any physical foundation:

$$\int_{-\infty}^{+\infty} |\psi(x)|^2 dx = 1$$

Although it is generally acknowledged that this equation cannot be explained in real terms, until now nobody has ever had the idea of solving this fundamental epistemological problem of quantum mechanics within the philosophical and cognitive frames of meta-mathematics, as is done in the new axiomatics. Schrödinger wave equation is an abstraction defined within mathematics, just as any other physical quantity or equation (see also chapter 7.2). This proves that physics, in general, and quantum mechanics, in particular, are mathematics applied to the real physical world. One cannot repeat this simple fact often enough. It is an established historical fact that with the development of quantum mechanics physicists began to doubt the formalistic approach of modern physics and felt intuitively that quantum formalism discredited the “realistic” approach inherited from classical mechanics. These doubts continue to the present day - they have materialized in numerous, highly confusing publications that make modern physics an epistemological mess.

#### 4.7 THE DOPPLER EFFECT

This survey on wave theory would be incomplete without discussing the **doppler effect**. We observe this universal phenomenon in all kinds of waves because it is a **manifestation of the reciprocal character of space and time**. Since matter and photon space-time are of wave character, the doppler effect is the universal verification of this fundamental property of the primary term, which we have deduced in an axiomatic way from our consciousness.

The doppler effect is fairly simple to understand: when a *wave source* and a *receiver* are moving relative to each other, the frequency observed by the receiver is not the same as that of the source. When they are moving towards each other, the observed frequency is greater than the source frequency; when they are moving away from each other, the observed frequency is less than the source frequency. This is the essence of the doppler effect. What is the interpretation of the doppler effect in the light of the Universal Law?

Let us consider the medium that is confined by the wave source and the receiver as a distinct system of constant space-time. For didactic purposes, we choose an electromagnetic wave, that is, we have a system of photon space-time, although our elaboration holds in any other medium. The space-time of

the photon system is determined by the distance between the wave source and the receiver which is [1d-space]-quantity. As long as the wave source and the receiver are not moving, the space of the photon system as measured by the distance is constant. In this case, the space-time of the system is also constant. This is also true for the time of the photon system, which is the complementary constituent to space. Indeed, the observed frequency is constant when the distance to the receiver remains constant.

When the wave source and the receiver are moving towards each other, the space of the photon system decreases. In this case, it is irrelevant which one of them is responsible for this relative change of distance. As the space-time of the photon system that is confined by the wave source and the receiver is constant, its time should increase in a reciprocal manner. This relative change is observed by the receiver as an increase in the frequency of the emitted electromagnetic wave: when [1d-space]  $\rightarrow 0$ , then  $f \rightarrow \infty$ , because  $f = 1/[1d-space]$ . When this phenomenon is observed for the visible light, the relative change of frequency is called **violetshift**.

When the wave source and the receiver are moving away from each other, the distance between them increases. In this case, the space of the photon system increases and its time decreases in a reciprocal way: when [1d-space]  $\rightarrow \infty$ , then  $f \rightarrow 0$ , because [1d-space] =  $1/f$ . This change in the frequency is called **redshift** when observed for the visible light.

As we see, the reciprocity of space and time that is assessed by the doppler effect can be adequately expressed with the number “1”. The doppler effect is usually summarized by the following equation<sup>126</sup>:

$$f' = \frac{(1 \pm u_r / v)}{(1 \pm u_s / v)} f_o = SP(A) f_o \quad (66),$$

where  $u_r$  is the speed of the receiver relative to the space-time of the photon system (medium) and  $u_s$  is the speed of the source relative to the space-time of the photon system. Equation (66) says that the relative change in wave frequency  $f'/f_o = SP(A) = time$  is a number (time relationship) belonging to the continuum  $n = SP(A)$ . This is the essence of physics and mathematics: all we can do in these disciplines is to build relationships between [1d-space]-,  $f$ -, or [nd-space-time]-quantities of selected systems of space-time and to obtain dimensionless numbers belonging to the continuum  $n$ . The doppler effect is basic to the new explanation of gravitation which we shall present in the next chapter.

---

<sup>126</sup> See, for instance, the standard derivations in PA Tipler, Physics, chapter 14-9.

## 4.8 THE MECHANISM OF GRAVITATION (ND)

Although modern physics has commenced with the measurement of gravitation (Galilei), it has been unable to develop a theory of gravitation that unifies this force with other forces, such as electromagnetic, weak and strong forces. This shortcoming of physics is generally acknowledged. While gravitation has been elevated to mystery, physics has degenerated to an esoteric search for the hypothetical *graviton*, through which this force should be mediated in empty space. This cognitive misery of modern physics is self-made - it stems from the wrong assumption that space is vacuum, in which gravitation is transmitted through hypothetical fields or particles.

None of the physicists so far has been fully aware of the fact that gravitational and electromagnetic fields are abstract mathematical concepts that have been introduced through human consciousness - the semantic (and not the experimental) search for their real meaning reveals that they are partial perceptions of **photon space-time**. The latter is an *aggregated set* that includes the *level of gravitation*, the *level of electromagnetism*, the *level of weak forces* and infinite other levels, of which we have no idea at present. For this reason we speak in the new axiomatics of infinite levels of space-time, whereas conventional physics reduces the physical world to only four forces (levels). As all parts of space-time are U-subsets that contain themselves as an element, the element being space-time, we enjoy the degree of mathematical freedom of aggregating the infinite levels of space-time to one level (space-time), two levels (axiom of reducibility), or  $n$ -levels of space-time ( $n = \text{continuum}$ ).

Therefore, we need not know all levels of space-time to describe the physical world. This task is impossible - one cannot depart from the parts, which are infinite, to define the whole. This approach is a vicious circle, to which present-day physics, used to define the abstract physical quantities, it has introduced in an *a priori* manner through mathematics, with the help of other physical quantities, e.g. acceleration with mass, charge with current etc., is subjected. This kind of physics is a Sisyphian labour - it does not enlarge our knowledge and is doomed to failure. The inability of traditional physics to explain gravitation is a particular symptom of this cognitive malaise. The only correct approach from an epistemological point of view is to depart from the whole to comprehend the parts. This is the essence of the Universal Law. As all levels manifest the properties of the whole, which is a closed entity (conservation of energy), we can aggregate the parts to appropriate sets and acquire the necessary information. This *information* consists only of space-, time-, or space-time relationships - it is equivalent to the continuum<sup>127</sup>.

---

<sup>127</sup> It can be proven that Shannon's definition of information is an iteration of the primary term.

For instance, we can describe the visible universe - the total set of space-time that we can assess at present - as an interaction between two levels: the photon level and the gravitational level. The result of this dynamic interaction is the extent of the visible universe as a circumference  $S_U = c^2/G = [1d\text{-space}]$ -quantity (equation (37)). When expressed in meters, this quantity is a relationship to the anthropocentric surrogate of 1  $m$ .

The gravitational level incorporates all gravitational objects, such as planets, suns, white dwarfs, neutron stars, red giants, quasars, pulsars, solar systems, black holes, galaxies, including radiogalaxies, Seyfert galaxies, local groups and so on. As we see, the gravitational level can be subdivided into infinite levels as each of the aforementioned gravitational systems can build a corresponding level, e.g. planet level, solar level, galactic level etc. As all levels are open U-subsets that contain themselves as an element, and space-time is a closed entity, it is not possible to distinguish between these levels in real terms, that is, to separate them. Nevertheless, each abstract definition of a level that is a distinct object of thought has a real correlate in space-time because such thoughts are U-sets. Only N-sets, such as the idea of vacuum, have no real correlates and should be excluded from scientific thinking.

This preliminary philosophical introduction intends to liberate the reader from false expectations that have been nurtured for centuries in the cultural medium of scientific agnosticism. Although such expectations exhibit an astounding resistance to logical arguments, the simple mechanism of gravitation as presented below is an adequate tool against this mental blockade - this simplicity is an aspect of the new axiomatic approach in physics.

The motion of planets or other gravitational systems is conventionally assessed by Kepler's laws and Newton's law of gravity. These laws are applications of the Universal Law for the space-time of gravitational rotation (chapters 3.5 & 3.6). Any real motion in space-time is a rotation. Let us now consider the rotation of the earth around the sun. The earth's orbit is an *ellipse* with the sun at one focus. The closest distance to the sun is called *perihelion*  $r_{min} = 147.1 \times 10^9 m$ , the farthest distance to the sun is called *aphelion*,  $r_{max} = 152.1 \times 10^9 m$ . The *semimajor axis*  $a$  equals half the sum of these constant distances  $a = 149.6 \times 10^9 m$ . The **numerical eccentricity**  $\varepsilon$  of the earth's orbit is  $\varepsilon = 0.016677$ . It is obtained from the *linear eccentricity* defined as the distance between the focus and the centre of the ellipse divided by the semimajor axis  $a$ :  $\varepsilon = 0.5(r_{max} - r_{min})/a = 0 \leq SP(A) \leq 1$ . For the two distances we get:  $r_{max} = a(1 + \varepsilon)$  and  $r_{min} = a(1 - \varepsilon)$ .

This simple geometry is the method of definition and measurement of gravitation in classical mechanics. What is the epistemological background of this traditional geometric approach to celestial motion? The linear eccentricity  $\Delta r$  can be regarded as  $[1d\text{-space}]$ -quantity of a new gravitational system that results from the interaction between the sun and the earth (axiom of reducibility) - it is constant for each planet because it reflects the constant space-

time of the resultant system. The numerical eccentricity  $\varepsilon$  is a relationship of two [*1d-space*]-quantities that belongs to SP(A). It assesses the relative change of the space-time of the photon system that is *confined* by the earth during its revolution around the sun. The background of this conclusion is fairly simple. If  $\varepsilon$  approaches zero, the earth's orbit will become a circle. However, this is not possible in the real physical world - it would mean that the space of the new system should be zero, that is, its space-time should also be zero. This example illustrates why we never encounter ideal circular motion in the real physical world - all real rotations of gravitational systems are ellipses or approximate this geometric form. In the ideal case of circular motion, the distance of the earth to the sun will remain constant during its revolution. This would mean that there should be no relativistic change in the space-time of the photon system confined by the circular orbit of the earth with the sun at its centre because the radius of this orbit represents a constant distance for all points of the orbit to the sun. Therefore, if the planet would have an ideal circular orbit, there should be no doppler effect between the earth as a source and the sun as a receiver. In real space-time, the earth *moves away* from the sun when it revolves from perihelion to aphelion and *approaches* the sun when it revolves from aphelion to perihelion. Thus the actual orbit of the earth affects a *relativistic* change in the space of the photon system confined by the earth's elliptical rotation. When the earth moves from perihelion to aphelion, the space of the photon system *expands*; when it moves from the aphelion to the perihelion the space *shrinks*. This relativistic change of the space leads to a reciprocal change in the time of the photon system that can be assessed by the doppler effect. Before we proceed with our explanation of gravitation, we shall solve at this place a basic epistemological problem of conventional physics that hinders an understanding of gravitation in terms of the Universal Law.

The earth's approaching to the sun and its subsequent receding from the sun along its orbit can be regarded as distinct motions and described as *attraction* and *repulsion*. Thus any real rotation, such as gravitational rotation, *consists* of a **period of attraction** and a **period of repulsion**. The two phenomena, attraction and repulsion of celestial bodies, result from the reciprocal behaviour of space and time. The same applies to the products of such rotations - the waves and oscillations that occur follow the doppler effect. This can be illustrated with the following example. If a mass particle oscillates around its fixed point when a wave is propagated in a medium, we can describe the motion of the particle either as repulsion or attraction with respect to the fixed point (see restoring force in Hooke's law).

We encounter the same phenomenon in electromagnetism. It is an established fact that charges with the same sign repel, while charges with opposite signs attract. Unfortunately, charge is an area - cross-sectional area of the antinode - so that positive and negative signs of charges are pure conventions within mathematics (chapter 6.2). They are mathematical symbols, with

which *constructive* and *destructive interference* of superimposed waves is formally assessed (chapter 4.3). The elementary idea of “attraction“ and “repulsion“ is thus an intuitive perception of the reciprocal character of space and time.

This insight affects another significant simplification in our outlook of the physical world. This fact is totally confounded in present-day physics. It encounters unsurmountable problems in providing a consistent interpretation of attraction and repulsion of charges in electromagnetism in contrast to gravitation where only attraction is considered, notwithstanding the fact that Coulomb’s law and Newton’s law of gravity are mathematically identical equations. In reality, gravitational attraction is a one-sided perception of this force when it acts at a small distance, for instance, when an object is attracted by the earth in a “free fall“. In this particular case, the path of motion is given as a straight line. However, any translation in space-time is a portion of a larger rotation and thus a geometric abstraction of the latter. If we consider, instead, a comet that approaches the earth and then recedes away from it, we can describe the comet’s orbit in terms of attraction and repulsion. As we see, these two terms are of anthropocentric origin - they represent unilateral, local perceptions of the reciprocity of space and time during rotation, which as the universal motion of space-time. From this elaboration, we come for the first time in the history of physics to the following fundamental conclusion:

There is no principal difference between *gravitation* and *electromagnetism* as levels of space-time. Both levels of space-time *engender attraction* and *repulsion* of systems during an interaction. Attraction and repulsion of gravitational objects and electric charges are a consequence of the reciprocity of space and time that manifests itself as rotations. Note: Recall that all gravitational bodies have a charge (cross-sectional area) and each charge has a mass, that is, it is subjected to gravitation - therefore they cannot exhibit different properties.

This conclusion is of paramount cognitive importance for our further elaboration of gravitation and electromagnetism, as both levels can be described in terms of wave theory.

Evidently, the space-time of the photon system confined by the earth’s orbit is subjected to relativistic changes when this planet completes one revolution around the sun. When the earth rotates from perihelion to aphelion, it moves away from the sun. We call this half of a revolution a *period of repulsion*. The **escape velocity**  $v_e$  from the sun during this period is obtained from the tangential velocity of the earth - it is a vector defined by the straight line connecting the earth with the sun that points away from the sun (see parallelogram method of vector addition). The tangential velocity of the earth alters its magnitude continuously during its revolution around the sun. The

same is true for the escape velocity:  $v_e$  begins to grow as soon as the earth leaves perihelion and achieves a maximal value  $v_{e(\max)}$ , which is a specific constant of the planet, somewhere between perihelion and aphelion. After that it begins to decrease continuously and becomes zero at aphelion, because the tangential velocity is perpendicular to the major axis at this point. When the earth moves from aphelion to perihelion, we have the reverse situation. In the *period of attraction*, the **velocity of attraction**  $\mathbf{v}_a$  to the sun behaves as a mirror image to the escape velocity  $v_e$  in the period of repulsion. The tangential velocity of the earth is the universal quantity of the kinetic space-time of this gravitational system. The relativistic change, to which the kinetic space-time of the earth is subjected during its revolution around the sun, is propagated to the space-time of the enclosed photon system. This change is mediated through the vertical energy exchange between this material system and the photon system.

The relativistic changes of space, time, or space-time during the vertical energy exchange between the rotating earth and the enclosed photon system can be assessed by the doppler effect. The gravitational force that occurs between the earth and the sun and determines the earth's orbit is propagated through this vertical exchange as an "action at a distance". The presentation of this interaction from a dynamic point of view is essential for an understanding of gravitation. We ought to observe that neither Newton's law of gravity nor Kepler's laws give any explanation of the actual mechanism of gravitation - these laws merely assess some secondary quantities of the gravitational level of space-time, such as force and acceleration. These laws have no epistemological background. This is considered a major deficiency of classical mechanics.

There are several didactic alternatives of explaining gravitation as vertical energy exchange between matter and photon space-time depending on the preferred quantities of the primary term. We shall implement a mixed approach to gravitation by using the conventional quantities of classical mechanics, such as *mass, density, acceleration, distance* and *velocity*. Although we shall discuss gravitation from a dynamic point of view, the mathematical calculations that will be discussed are of static character. As physics has not yet developed a mathematical instrumentarium of describing space-time in a dynamic way, we are constrained to use traditional data. Besides, it is not the objective of the present book to introduce novel dynamic methods of mathematical calculus in physics, but to prove that there is only one law of nature. Nevertheless, we shall show how such sophisticated methods can be principally implemented. Therefore our approach will be essentially epistemologic and descriptive.

We begin our discussion with the *primary axiom*, space-time = energy exchange. When this axiom is applied to the earth as a particular gravitational system, it postulates that its space-time remains *constant* because it reflects the closed character of space-time. This is defined at present as conservation

of energy. At the same time the earth is an open system - it interacts with the universe through its vertical energy exchange with the photon level. We can describe the earth as an *input-output* system that exchanges energy with the universe through photon level, for instance, gravitational, electromagnetic and thermodynamic energy. This input-output process of vertical energy exchange is described by several conventional laws of thermodynamics, such as *Stefan-Boltzmann law* and *Wien's displacement law*. These laws describe the emission and absorption of photons by matter. We shall discuss these applications of the Universal Law in detail in chapter 5.5 of thermodynamics.

Thus emission and absorption of photons describe the vertical energy exchange between matter and photon space-time that takes place in both directions. As mass is an important quantity in mechanics - for instance, in Newton's law of gravity the gravitational force  $F_G$  is given as a function of the mass of the interacting objects - we shall use the quantity *mass* to explain the mechanism of gravitation.

As photons have a mass (see equation (44)), when an object of matter emits photons, it loses mass; when it absorbs photons, it gains mass. This input-output process is in balance for each system with respect to the universe, that is, input (resorption) = output (emission). This is the reason why space-time of systems is constant although they are open and exchange incessantly energy. When applied to material objects, this condition is called "**blackbody radiation**" in thermodynamics. The concept is an N-set - it considers a blackbody as a *closed* system: "An object that absorbs all the radiation incident upon it has an emissivity equal to 1 (certain event) and is called a blackbody."<sup>128</sup> This intuitive idea of the closed character of space-time in thermodynamics is basic to the definition of Stefan-Boltzmann law (chapter 5.5). Indeed, all particular laws can only be defined when the properties of the primary term are considered.

The mass of the photons depends on their frequency  $m_{photon} = m_p f$ . As all systems are U-sets - they contain themselves, i.e., space-time, as an element - the mass of the basic photon  $m_p$  is part of the macroscopic mass  $M_{mol}$  of gravitational objects (see equations (46), (46a) and (46b)):

$$M_{mol} = m_p(n_{pr}f_{c,pr} + n_n f_{c,n} + n_e f_{c,e})nN_A ,$$

where  $n_{pr}$ ,  $n_n$ ,  $n_e$  = number of protons, neutrons and electrons of the substance, and  $n$  = number of mols of the object. In this elaboration, we can alternatively use *Planck's equation*  $E = hf = E_A f$  of photon energy without affecting the final conclusions.

Both *Stefan-Boltzmann law* of the *power of radiation*  $P = e\sigma AT^4 = E_A f$  (80) and *Wien's displacement law* of the *wavelength of maximal radiation*  $\lambda_{max} = B/T$  (81) assess the space-time, respectively, the space (wavelength) of the emitted

---

<sup>128</sup> PA Tipler, p. 531

photons, as a function of temperature  $T$  (chapter 5.5). We shall prove in thermodynamics that temperature is a quantity of time  $T = f$  (chapter 5.1). The new *Stankov's law of photon thermodynamics* confirms that any thermal gradient at the material levels leads to a corresponding thermal gradient at the photonic level during radiation, which is a specific vertical energy exchange between matter and photon space-time (chapter 5.7).

In the present discussion, we shall not consider the energy exchange of the earth with the rest of photon space-time; we assume that the input is equal to the output (primary axiom). The same holds for the sun. We shall only describe the relativistic change in space and time of the enclosed photon system during one revolution of the earth around the sun. However, we do not say that the earth is a closed system - we merely use the notion of the primary axiom in the sense of "*ceteris paribus*" (other things the same). This is an *a priori* condition in any mathematical presentation of real space-time - for instance, we can only build equations under the condition of *ceteris paribus*. This abstract assumption is especially popular in economics<sup>129</sup>.

When the earth moves from perihelion to aphelion, the escape velocity increases continuously to the maximal value  $v_{e(max)}$  and after that decreases continuously to zero at aphelion. This relativistic change in the kinetic energy of the earth produces an equivalent change in the space-time of the expanding photon system confined by the earth's orbit. This change is assessed by the doppler effect  $f_x = (1 - v_e/c) f_o$ , where  $f_x$  is the actual frequency of the photons emitted from the earth to the photon system;  $f_o$  is the baseline frequency. Based on the aforementioned geometric approach in celestial mechanics,  $f_o$  is the hypothetical constant frequency of the photons, which the earth would emit if its orbit were an ideal circle, that is, when the numerical eccentricity  $\varepsilon$  is set zero. In this case, the distance of the earth to the sun would be constant - for instance, it can be set equivalent to the semimajor axis  $a$ . During the period of repulsion, the frequency of the photons emitted by the earth as a source continuously decreases with respect to the sun and the enclosed photon system. The maximal redshift will be observed at  $v_{e(max)}$ . Moving from the point of  $v_{e(max)}$  to aphelion, the redshifts of the earth will continuously decrease. At aphelion, there will be no redshift at all, because  $v_e = 0$  and  $f_x = f_o$ . The change in the frequency  $\Delta f$  during the period of repulsion can be assessed by differential calculus. The maximal change  $\Delta f_{max}$  is achieved at  $v_{e(max)}$ . It is inversely proportional to the maximal linear eccentricity of the earth's orbit  $\varepsilon = \Delta r/2a = (r_{max} - r_{min})/2a$ . When the universal equation is applied as a rule of three (36-1), we obtain a simple relationship between the numerical eccentricity of the earth's orbit and the change in frequency of the enclosed photon system:

---

<sup>129</sup> K. Lancaster, Introduction to modern microeconomics, Rand McNally College Publishing Company, Chicago, 1974, p. 12.

$$\varepsilon = \frac{\Delta r}{2a} = \frac{f_o}{\Delta f_{max}} = SP(A)$$

The maximal escape velocity  $v_{e(max)}$  of each planet can be obtained from astronomical tables. From  $v_{e(max)}$  and the maximal change  $\Delta f$  we can determine the maximal redshift of the earth by calculating the doppler effect (66). We can now apply the same procedure to the period of attraction when the planet moves from aphelion to perihelion and determine the maximal velocity of attraction  $v_{a(max)}$ . It will correspond to the *maximal violetsift*. If we use differential and integral calculus, we can calculate the magnitude of these quantities for each point of the planet's orbit and thus determine precisely the relativistic changes in space (distance from the sun) and time (frequency) of the photon level during one revolution. The frequency of the photons determines the energy of the photon system  $E \approx f$ . The same is true for its density. If we now apply the universal equation for one complete revolution, we obtain another valuable relationship:

$$\frac{E_{repulsion}}{E_{attraction}} = \frac{\rho_{repulsion}}{\rho_{attraction}} = \frac{v_{e,max}}{v_{a,max}} = constant = 1$$

The space-time of the enclosed photon system changes relativistically within one revolution. From perihelion to aphelion, space continuously expands and photon frequency decreases in a reciprocal manner as observed by the redshifts. The density of the enclosed photon system decreases in the same manner and achieves its minimal value  $\rho_{min}$  at aphelion. This minimal density gradually increases during the period of attraction. The overall density of the period of repulsion is equal to that of the period of attraction. Same holds for the energy exchange and the maximal velocity of the two periods (conservation of energy).

The revolution of the earth around the sun can be regarded as an *action potential* or, alternatively, as an interaction between the earth and the photon system (axiom of reducibility). In this elaboration, we regard energy exchange between the sun and the photon system under the condition "*ceteris paribus*", We apply the same condition to the energy exchange between the earth and the universe. During one revolution of the planet, we observe the reciprocal behaviour of the LRC of the two contiguous levels - the level of matter, as represented by the earth, and the photon level, as represented by the enclosed photon system. When the earth moves from perihelion to aphelion, it emits photons with a decreasing frequency and mass  $m = m_p f$ , that is, the earth loses continuously mass to the photon system. As the input from the universe is unchanged, the earth, so to say, "gains weight" during the period of repulsion. The planet exhibits maximal mass and density at aphelion, which is the farthest distance to the sun:  $r_{max} = [photon-space]_{max}$ . At this point, the enclosed

photon system behaves reciprocally to the earth - its energy, LRC, mass and density, being proportional to the frequency of the emitted photons, reach their minimal values. According to Newton's law of gravity, the gravitational force is proportional to the mass of the interacting objects. From this it follows that gravitation augments during the period of repulsion and achieves its maximal value at aphelion, where the mass of the earth is maximal. At this point, the attraction of the earth to the sun begins (period of attraction). At the end of the period of attraction, that is, at perihelion, which is the shortest distance to the sun, the mass of the earth is minimal and the planet begins to move away from the sun.

During the period of attraction, the earth emits photons with growing frequency (violetshifts) and mass: so to say, the planet begins to "lose weight". At perihelion, the earth has a minimal energy, mass and density. At the same time, the enclosed photon system reaches its maximal energy, density and mass, and the smallest space. The gravitational force between two objects is proportional to their mass and inversely proportional to their square distance as stated by Newton's law of gravity. To compensate for the diminishing mass of the earth the distance to the sun begins to augment, so that the overall gravitational energy remains constant. The earth begins to move away from the sun. These descriptions are circumlocutions of the reciprocal behaviour of the LRC of contiguous levels.

This is one possible explanation of gravitation as a rotation with respect to the law of gravity. Alternatively, we can describe the turning points at aphelion and perihelion with the *restoring force* in Hooke's law. We can regard the space-time of the photon level as an elastic medium (ether). When the enclosed photon system expands maximally at aphelion, photon space-time at the opposite side of the earth contracts and develops a restoring force that brings the earth back to the sun. When the space-time of the photon system reaches its maximal state of contraction (maximal restoring force) at perihelion, it begins to expand by taking the earth with itself. This phenomenon can be observed in fluids and elastic matter. Such didactic presentations are descriptive iterations of the basic property of space-time - the reciprocity of space and time. They visualize the mechanism of gravitation by showing that it obeys the Universal Law, which is ubiquitous in all physical phenomena. The mystery of gravitation is thus demythologized once and for all.

The revolution of the earth around the sun is a periodic event of constant space-time  $E_A$ , which repeats infinite times  $E = E_A f$ . If we regard the orbit of the sun as a revolution path around the centre of our galaxy, the Milky Way, we shall obtain for the earth's orbit an eccentric wave *oscillating* around the sun's orbit. This example shows that all gravitational rotations can be described in terms of superimposed waves, which are U-sets and contain themselves, that is, space-time, as an element. In this sense, we can regard the universe as the total set of all superimposed rotations which are systems or levels of the primary term. This holds for macrocosm and microcosm. The

elementary particles can also be regarded as rotating systems of space-time (see quantum mechanics).

This presentation includes a new aspect that facilitates our understanding of gravitation dramatically. We depart for the first time in the history of physics from the vertical energy exchange between matter and photon space-time and show that it follows the Universal Law, just as any other energy interaction. The crucial fact is that photon space-time exhibits the same properties as matter, for instance, photons also have a mass which is energy relationship. Current physics preaches instead that only matter has a mass, while photons are „massless“ particles. This novel explanation of gravitation was enabled by major breakthroughs in classical mechanics, wave theory, thermodynamics and quantum mechanics as presented in this volume. It shows that gravitation is a particular energy exchange, just as electromagnetism and heat, and can be consistently integrated with other forces (levels of energy exchange). This simple interpretation of gravitation in the light of the Universal Law eliminates the search for the hypothetical graviton as obsolete.

## 5. THERMODYNAMICS

### 5.1 WHAT IS TEMPERARUTE ?

**Thermodynamics** studies *temperature*, *heat* and the *exchange of energy*. This branch has the same universal role in physics as wave theory. The basic quantity of space-time in thermodynamics is **temperature  $T$** .<sup>130</sup> It is as familiar to us as conventional time. While the idea of time is based on the aggregated sensation of energy exchange in the body and the surroundings, mainly perceived as motion in transition, our idea of temperature is linked to the sensation of warm and cold that is transmitted to the central nervous system by tactile senses. Contrary to other abstract physical quantities, temperature and time are physiologically associated with our sensations. Precisely for this reason, though, temperature (and conventional time) has not been understood.

Temperature is defined by a change in space. In thermodynamics, this change is measured three-dimensionally as volume [*3d-space*]. It is very important to observe that the change in space is the primary event, while its association with thermal sensations, such as “warm“ and “cold“, is of secondary anthropocentric character. Therefore, we should clearly distinguish between the subjective perception of temperature and its abstract, geometric definition as a physical quantity. When the universal equation (36-1) is applied to the definition of temperature as a change in volume, we can show that it is a concrete quantity of **time**:

$$T = f = [3d-space]_x / [3d-space]_R = f_R / f_x = SP(A) \quad (67)$$

As with all other quantities, the method of definition of temperature is at the same time its method of measurement. This fact is at best illustrated in a survey on the historical development of *temperature scales*. The method of definition and measurement of  $T$  reveals a fundamental property of space-time that has not been realized so far - temperature can only be measured in **thermal contact**. This fact reveals the continuousness of space-time. As  $T$  is time, and  $f$  is a quantity of energy exchange  $E \approx f \approx T$ , this would mean that thermal exchange takes place between contiguous levels - space-time is *continuous*. This fundamental property of space-time also includes photon space-time. This aspect is not fully comprehended in thermodynamics.

---

<sup>130</sup> We use for temperature the symbol “ $T$ “ in kelvin, which is the official SI unit. When temperature is explicitly given in the Celsius scale, we shall use  $t_C$ .

The measurement of  $T$  takes place in **thermal equilibrium**, also known as the **zeroth law of thermodynamics**. This law says that if two objects are in a thermal equilibrium with a third (through contact), they are in thermal equilibrium with each other. This is an intuitive notion of the primary term as a continuum. The zeroth law anticipates the existence of a common thermodynamic level of space-time, which is part of all material objects (U-subset of matter). The absolute time of this level is constant  $T = cons.$ , because its space-time is also constant. We shall elaborate this aspect in detail below. As we see, all basic ideas of physics are intuitive perceptions of the nature of the primary term. This also holds for thermodynamics.

Thermal contact and equilibrium are the real prerequisites for the definition and measurement of temperature. According to the principle of circular argument, one needs a reference system (building of equivalence) to make a comparison (building of relationships). The choice of the reference system to which the temperature of the objects is compared has evolved with time. The *mercury column* of the normal thermometer is such a reference system. From a theoretical point of view, the choice of the substance is of no importance - mercury can be substituted by any other substance. This liquid metal has been selected for practical reasons. The choice of the geometric shape of the mercury column is, however, not accidental. It is a *cylinder* with the same cross section along the whole length of the scale, so that equivalent changes of the mercury volume lead to equivalent changes of the column length:  $\Delta[3d\text{-space}] \approx \Delta[1d\text{-space}]$ . Thus, the building of equivalent increments of mercury volume, which can be regarded as constant action potentials  $E_A$ , is the *a priori* condition for the measurement of temperature  $T = f$  and heat  $Q = E = E_A f$ .

Once the building of real space equivalences is ensured by applied geometry, mathematics is subsequently introduced as the method of measurement. The historical procedure has been the following: the normal **freezing point** of the water (*ice-point*  $T$ ) has been assigned the number "0", the normal boiling point of water (*steam-point*  $T$ ) - the number 100. The unit of volume change is arbitrarily called "**degree**" and is written as  $0^\circ C$  or  $100^\circ C$ .  $C$  stands for *Celsius*, who was the first to introduce this scale - hence **Celsius temperature scale**. The length of the mercury column at  $0^\circ C$  is  $L_0$  and at  $100^\circ C$  it is  $L_{100}$ . The length difference  $\Delta L = L_{100} - L_0$  is subdivided evenly into 100 segments, so that each length segment corresponds to "1 *degree*"<sup>131</sup>. The number "100" for  $\Delta L$  is voluntarily selected. Within mathematics, we can assign this magnitude any other number, for instance, "1" as the certain event or 1 unit, without affecting the actual measurement of temperature. From this we conclude that the number 100 of the Celsius scale is a simple conversion factor  $K = SP(A)$  of space measurement. This becomes evident when we

---

<sup>131</sup> It is important to observe that the same procedure is also used to define "per cents". The term "per cents" is a universal numerical relationship of any real or abstract quantity.

compare the Celsius scale with the Fahrenheit temperature scale (see exercise 1. below). **Celsius temperature**  $t_c$  is defined as:

$$t_c = \frac{L_t - L_0}{L_{100} - L_0} \times 100^\circ = \frac{\Delta L_x}{\Delta L_R} = \frac{[1d - space]_x}{[1d - space]_R} = \frac{f_R}{f_x} = f = SP(A) \quad (67a)$$

or

$$[1d-space]_x f_x = [1d-space]_R f_R = v_x = v_R = [1d-space-time]_{thermal} = cons. \quad (67b)$$

Equation (67b) proves that:

“Thermal equilibrium“ is a tautology of the constant space-time of the **thermodynamic level of matter**.

However, the actual space and time (temperature) magnitudes are specific for each substance or object that can be regarded as a distinct thermal system - hence the necessity of measuring its particular temperature (time) and volume (space). The same holds true for their relativistic changes. All we can do in physics is to measure space, time and space-time of the systems and levels.

Thermodynamics confirms that space-time is an incessant energy exchange. This discipline has developed the most adequate perception of the primary term. Therefore, it is not surprising that the *first law of thermodynamics* assessing the **conservation of energy** is a static perception of the Universal Law, as it is no coincidence that its discoverer, Julius Robert Mayer, was a physician as the author of the present book. Both of them studied medicine in Germany and first discovered the Universal Law as a law of conservation for organic matter, and only after that confirmed it in physics (in 1842, respectively, in 1995)<sup>132</sup>. Space-time is a cyclic phenomenon in evolution. This is also true for the history of any scientific discovery concerning space-time<sup>133</sup>.

Although mercury thermometers are commonly used, they are not very precise outside their calibration points. The *constant-volume gas thermometer* enjoys this virtue to a greater extent. Instead of volume change, it measures

<sup>132</sup> While Mayer was at first rebuked for his metaphysical style of scientific presentation and suffered from neglect, we can hope that the new axiomatics of the Universal Law will enjoy a more cheerful destiny. At least, one cannot argue that I do not understand Newton's laws as was the case with Mayer. In fact, it was Newton that did not understand gravitation. This is true for any physicist before and after him.

<sup>133</sup> One may speculate, whether it is a coincidence that the discoverer of the Universal Law comes from Thracia, which is the cultural homeland of Heraclitus, the first discoverer of the Universal Law, the atomists, the first really modern scientists of the Old continent, and Aristotle, the universal genius of antiquity, who developed a universal categorical system of science based on the intuitive (or maybe rational) perception of the Universal Law. The answer will be given in the near future.

change of pressure. This *isobaric* measurement of temperature is based on the **ideal-gas law**. We shall show below that it is an application of the Universal Law. The further refinement of temperature scales reflects the inherent striving of man for precision in assessing space-time. Because of the difficulties in duplicating the ice-point and steam-point states with high precision in different laboratories, a temperature scale based on a single fixed point was adopted in 1954 by the International Committee on Weights and Measures - the **triple point of water**. This equilibrium state occurs at a pressure of 4.58 mmHg and a temperature of 0.01°C. The ideal-gas temperature scale is defined so that the temperature of the triple point is  $T = 273.16$  *kelvins* ( $K$ ), where “degree kelvin“ is a unit of the same size as the Celsius degree. The number 273.16 is thus a conversion factor ( $T = t_c + 273.16$ ). As the triple point of water was found to be unprecise, in 1990 a new fixed point for the Kelvin scale was introduced based on 17 calibrating points (minimisation of systemic failure). This is not the end of the story. With the discovery of the Universal Law, it will be possible to define a new, more precise temperature scale that will be based on photon space-time as a reference system. The scientific foundation of such a scale is based on the knowledge that temperature is a quantity of time (see *Stankov's law* in 5.7).

*Exercises:*

1. Express the conversion factor of the Fahrenheit temperature scale to the Celsius scale in the new space-time symbolism.
2. Determine the space-time dimensionality of the *coefficient of linear expansion*  $\alpha$  and the *coefficient of volume expansion*  $\beta$ . Discuss these quantities in the light of the new axiomatics. Suggest at least three applications of the Universal Law in the production and construction of materials subjected to significant thermal expansion or contraction.

## 5.2 THE IDEAL-GAS LAWS

The **ideal-gas laws** are concrete applications of the Universal Law for the **gas level** (U-subset of matter) that lead to the derivation of **Boltzmann's law**. The latter is the generalized form of the Universal Law for the **thermodynamic, kinetic level** of matter. These laws are based on the principle of circular argument: if we compress gas, that is, if we exert a force  $F$  on it, while keeping the temperature constant  $T = f = \text{cons.}$  (building of equivalence), we find that the **pressure** increases as the volume decreases (comparison). Similarly, if we cause a gas to expand at constant temperature, its pressure decreases as its volume increases:

$$P = F/A = SP(A)[1d\text{-space-time}]f/[2d\text{-space}] = SP(A)f^2/[1d\text{-space}] \quad (68)$$

In this case, pressure is an abstract quantity of space-time; it is of the same character as *tensile stress* (48) or *density* (47). When pressure is exerted on gases, or other contractible materials, their density increases and vice versa. This quantity reflects the reciprocal character of space and time. We have shown that the quantity density is proportional to the amount of energy, which is reciprocal to space. This fundamental property of space-time was first discovered by *Robert Boyle* (1662) and independently from him by *Edme Mariotte* (1676), and is known as **Boyle-Mariotte's law**:

$$PV = \frac{SP(A)f^2[3d - space]}{[1d - space]} = SP(A)[2d - space - time] = E = cons. \quad (69)$$

It says that the space-time of the gas level is constant at constant temperature:  $E \approx T = f = cons.$  The constancy of the space-time of the parts is a manifestation of the constancy of space-time due to its closed character. This is a fundamental axiom of the new theory with an ubiquitous validity. **Boyle-Mariotte's law** is one of the oldest mathematical derivations of the Universal Law for a distinct level of space-time. Its subsequent implementation in practice led to the development of **steam-engines**, with which the industrial era commenced. This was a breakpoint in the evolution of mankind. It gives us an idea of the scale of the industrial revolution that will occur in the next millennium when the Universal Law is broadly comprehended and applied to different levels of space-time. Especially its application to photon space-time and the underlying levels of energy will open up a new unlimited source of energy that will transform mankind to a trans-galactic species (see *Stankov's law*).

**Boyle-Mariotte's law** is a *linear* relationship between space-time and space at low densities. When the density is very high, new levels of matter (space-time) are created that exhibit a different linear relationship - that is, when we increase or decrease space significantly, we obtain different, new levels of space-time, which are **inhomogeneous**. The energy-space relationships of such levels are **scale-variant** - they are specific for each level. At present, most laws, such as Newton's law of gravity, are considered scale-invariant, although this is already doubted. Scale-invariance is an abstract idea born within mathematics - just as the law of inertia, it stems from the assumption of homogeneous empty space (vacuum) - and should be rejected on purely theoretical grounds. For instance, the scale-invariance between space-time and space or time only holds in "*ideal-gas*", which is an abstract concept of the mind. It is a closed system, just as the elastic collision or blackbody radiation.

Before we proceed with the ideal-gas law, we shall first introduce another historical presentation of the Universal Law for gases, the so called **Gay-**

**Lussac's law.** It was experimentally discovered by *Jacque Charles* and *Gay-Lussac*. They found that when the pressure, that is, space-time, is kept constant  $E = cons.$ , the absolute temperature, that is, time, is proportional to the volume of a gas:

$$PV = CT = SP(A)[2d\text{-space-time}] = E_A f, \text{ where } C = E_A \quad (70)$$

$C$  is a **constant of proportionality** appropriate to a particular system of gas. It represents an action potential that is a specific constant amount of energy for each particular gas system. In thermodynamics, this quantity is given with respect to *Avogadro's number*  $N_A$  and *Boltzmann's constant*  $k_b$ . The latter is fundamental to *Boltzmann's law*:

$$C = k_b n N_A = k_b N \quad (71)$$

As Avogadro's number is a quantity of time  $N_A = f = SP(A)$  (see equations (46a) & (46b)), **Boltzmann's constant** is obviously an action potential, which is obtained within mathematics when the Universal Law is applied as a rule of three (36-1):

$$\frac{C}{k_b} = \frac{E_{macro}}{E_{micro}} = \frac{E_{A(macro)}}{E_{A(micro)}} = n N_A = f = SP(A) \quad (71a)$$

Equation (71a) shows that Boltzmann's constant is an action potential of the microscopic atomic level, while *Avogadro's number* is the time of the corresponding macroscopic **mol-level**  $N_A = f_{mol}$  (see chapter 3.9). This insight affects a great simplification in our understanding of thermodynamics. The new axiomatics tells us that within mathematics, we have the degree of freedom to define each action potential as energy (space-time) and vice versa when we set the time:  $f = 1$ :  $E = E_A f = E_A$ . Therefore we can rewrite equation (71) as follows:

$$C = k_b n N_A = E_A f_n f_{mol} = E_A f = E_A, \text{ when } f_n f_{mol} = f = SP(A) = 1 \quad (71b)$$

Equation (71b) illustrates the **universal mathematical procedure** for creating new quantities and terms in physics:

We can always define the space-time or a quantity of the infinite underlying levels of a system as the certain event  $SP(A) = 1$  or, alternatively, as 1 *unit* and compare the space-time of the other systems with it.

The capacity of the mind to synthesize discrete subsets of space-time to a unity, e.g. integral calculus, theory of probabilities, and to differentiate the primary

term into distinct levels or systems, e.g. differential calculus, is the **universal operational principle** not only of physics and other natural sciences, but also of simple **calculation**. For instance, when we count objects of matter such as apples, we, in fact, assign each apple the number “1“ by aggregating all underlying levels of the apple, e.g. cells, molecules etc., in an unconscious, *a priori* manner. Without this intrinsic propensity of our mathematical consciousness, the physical world would be *incommensurable*, that is, it would be *unintelligible* and the development of science would be impossible. Thermodynamics is an adequate area to illustrate this property of the mind. From equations (71) to (71b), we obtain the **ideal-gas law** as an application of the Universal Law:

$$PV = nN_A k_b T = nRT = E_A f_n f_{mol} f_T = E_A f = E, \text{ where } f = f_n f_{mol} f_T \quad (72)$$

$R = k_b N_A = E_A f$  is the **universal gas constant**. Its value is the same for all gases. This is not at all surprising -  $R$  assesses the constant space-time of the *gas mol-level*. Alternatively, it can be expressed as an action potential  $C = Rn = E_A f$ .

*Exercises:*

1. Solve the ideal-gas law for the *gas density* and express this application of the Universal Law in the new space-time symbolism.
2. Build *plots of P versus V* for various temperatures. Show that these *isotherms* are geometric presentations of discrete gas levels.

### 5.3 BOLTZMANN'S LAW AND THE KINETIC THEORY OF GASES

The interpretation of the ideal-gas law from the point of view of classical mechanics is called the **kinetic theory of gases**. It reflects the basic axioms of the new theory. At the same time, the kinetic theory of gases exhibits the principal flaws in the outlook of conventional physics. Microscopically, the pressure of a gas is explained as the result of “*elastic collisions*“ between the gas molecules and the wall of the container. The latter represents a contiguous level of vertical energy exchange. The pressure is calculated by the rate of change in momentum of the gas molecules due to collisions with the wall of the container. By Newton's second law, the force exerted by the wall on the gas molecules is  $F = dp/dt$ . By Newton's third law, this force equals the force exerted by the molecules on the wall, while the force per unit area (geometry) equals the gas pressure. This is an application of the axiom of conservation of action potentials. This simple mechanistic view of the microcosm is based on several assumptions of abstract character: a) The molecules make elastic collisions with each other and with the wall (closed systems); b) The molecules are tiny particles that are separated, on average, by distances which are large when compared with their diameters. They exert no forces on each other

except when they collide (assumption of vacuum as an N-set that contains the microscopic systems of space-time as mass points); c) In the absence of external systems, there is no preferred position for a molecule in the container, and there is no preferred direction for the velocity vector.

This view is an application of the principle of circular argument for the microcosm that is analogous with the cosmological principle for the macrocosm. It is assumed that the molecules are moving fast enough to neglect gravity. This is another hidden definition of a closed system. As velocity is the universal quantity of energy exchange, this would mean that the energy of the thermodynamic, kinetic level is much greater than that of the gravitational level of matter. This allows the elimination of gravitational space-time by mathematical abstraction. As the **average kinetic energy of the molecules**  $K_{av}$  is much greater than gravitation  $E_G$ , that is,  $E_G/K_{av}$  approaches zero, we might as well assume that gravitation also approaches  $E_G \rightarrow 0$  when compared to  $K_{av}$ . Therefore, the assumptions of the kinetic theory of gases hold only in *ideal gas* that is free of gravitation. It is regarded as being composed of “elastic mass particles without space“. Thus the concept of “ideal gas“ is a geometric abstraction. When the ideal-gas law is solved with respect to the average velocity  $v_{av}$  of the molecules within geometry (method of definition and measurement)<sup>134</sup>, we obtain **Boltzmann’s law** of the **average kinetic energy** of the thermodynamic level:

$$K_{av} = (\frac{1}{2}mv^2)_{av} = 3/2k_bT = 3/2(R/N_A)T = E_{micro} = E_{Af} \quad (73)$$

$$K_{av} = N(\frac{1}{2}mv^2)_{av} = 3/2Nk_bT = 3/2nRT = E_{macro} = E_{Af} \quad (73a)$$

Equation (73) considers the kinetic energy of translation per one molecule of gas (molecular level), while equation (73a) describes the kinetic energy per *mol* substance (mol-level). **Boltzmann’s constant**  $k_b$  is the **constant action potential** of the **kinetic molecular level**. The quotient  $3/2 = SP(A)$  results from the geometric method of derivation. Boltzmann’s law is based on the primary idea of the average velocity of molecules, which, according to the principle of circular argument, is the only method of definition of a level. The kinetic action potentials of the molecules, which are considered in an *a priori* manner equal in the mean, build an abstract thermodynamic level of constant space-time in motion -  $K_{av}$ . Only when this equivalence is assumed, can we define various systems and levels of matter, for instance, *n-mol*-systems. From this elaboration we conclude that the thermodynamic, kinetic level is an abstract mathematical category of matter.

Boltzmann’s law can be expressed as a **statistical function** of velocity within mathematics. The so called **Maxwell-Boltzmann energy distribution function** is the first major application of the theory of probabilities in physics. It

<sup>134</sup> The conventional derivation of this law is given in PA Tipler’s Physics, chapter 15-5.

recognizes that the space-time of a level is an **assembly** (U-set) of discrete energetic events. This is an anticipation of the inhomogeneous character of the primary term as it is set forward in quantum mechanics. The latter has evolved historically from thermodynamics (section 5.). At the same time, the Maxwell-Boltzmann energy distribution function illustrates the intrinsic propensity of mathematics to evolve into a symbolic system of infinite complexity:

$$F(E) = \frac{2}{\sqrt{\pi}} \left( \frac{1}{k_b T} \right)^{3/2} E^{1/2} e^{-E/k_b T} = K_{av} = E_A f \quad (74)$$

Boltzmann's law is highly esteemed in physics because of its degree of abstraction - it proves that the kinetic thermodynamic energy of matter depends only on *temperature*, which is a quantity of time for this level  $E \approx T = f$ . Alternatively, the space-time of this level can be expressed as a function of the mean velocity, also called **root mean square speed**  $v_{rms}$  (see also exercise 1. below):

$$f(v) = \frac{4}{\sqrt{\pi}} \left( \frac{m}{2k_b T} \right)^{3/2} v^2 e^{-mv^2/2k_b T} = [1d - space - time] \quad (74a)$$

Velocity is the universal quantity of energy exchange that manifests itself as motion. It is basic to classical mechanics, wave theory and quantum mechanics. Any level has a specific constant velocity: while the photon level has the constant speed of light  $c$ , the thermodynamic level of matter has the constant speed of  $v_{rms}$ . We shall show in chapter 5.5 that the **constant B** of *Wien's displacement law* is the mean velocity of another distinct level of matter that determines the frequency (time) of the emitted photons. Therefore, the reader should not be surprised by the fact that thermodynamic energy of matter can be reduced to two quantities,  $T$  as time and  $v_{rms}$  as one-dimensional space-time.

Boltzmann's law creates a cognitive problem that should be elaborated in detail. By this law, the kinetic energy of molecules is proportional to temperature because it is a quantity of time. At the same time temperature is proportional to an increase in volume of material systems as measured by a mercury thermometer. On the other hand, we ascertain that energy is inversely proportional to space. How can we solve this paradoxical impression? Very simply: the energy that is contained in matter is the aggregated product of the underlying particles. All particles, such as electrons, protons and neutrons, have a constant space (Compton wavelengths), time (Compton frequencies) and space-time (energy or mass at rest). We can consider the thermodynamic level of molecules as a meta-level of matter that constitutes of various levels of particles. Like all other levels, this microscopic level also exhibits constant space (volume) and time  $T$ , respectively, space-time. At the same time, all

levels of space-time are open. The thermodynamic level exchanges energy with the underlying levels of particles and can change relativistically in each particular system of matter - hence the necessity to measure the time, that is, the temperature  $T$  of a system. The kinetic energy  $K_{av}$  or the mean speed  $v_{rms}$  of molecules result from this incessant energy exchange with the levels of particles. As the electron level exhibits the greatest space among all levels of particles, this level contributes essentially to the volume of the thermodynamic level. In the classical kinetic theory of gases, elastic collisions between particles are explained with an uneven distribution of electric charges within the molecular structure that cause electromagnetic attraction or repulsion of particles. These electromagnetic interactions, defined as elastic collisions, are made responsible for molecular motion<sup>135</sup>. They determine the magnitude of  $K_{av}$  and  $v_{rms}$ , that is, the volume of the thermodynamic level.

“Elastic collision of molecules“ is a basic paradigm of the kinetic theory of gases - it presupposes that horizontal energy exchange at the thermodynamic level is closed, by eliminating the gravitational interactions between the particles. The Maxwell-Boltzmann energy distribution function departs from this concept and assesses statistically the behaviour of molecules in an assembly. Unfortunately, this approach allows the theoretical possibility that molecules can arrange to a higher order (Poincarè’s argument on behalf of the reversibility of entropy). This view is in an apparent contradiction to the second law of thermodynamics which postulates growing entropy (disorder) at the thermodynamic level. Evidently, the two basic concepts of thermodynamics - the kinetic theory of gases, leading to the first law (chapter 5.4), and the idea of growing entropy, leading to the second law - build a fundamental paradox. Below we shall solve this antinomy of thermodynamics by refuting the notion of growing entropy (chapters 5.6 & 5.7).

If we explain the behaviour of the thermodynamic level considering its vertical energy exchange with the underlying levels of particles, we can easily perceive why any increase in temperature goes hand in hand with an increase in volume (except in phase transitions when new levels of matter are built). The energy of the particles is much greater than that of the kinetic thermodynamic level. When a certain amount of energy is liberated from the levels of particles and transformed into kinetic energy of molecules  $K_{av}$ , the volume of matter increases in a global manner (U-set) because the space of the thermodynamic level is much bigger than that of the levels of particles. This is due to the fact that space is inversely proportional to energy, for instance, strong, nuclear forces are much greater than electromagnetic forces.

---

<sup>135</sup> It is important to observe that *chemistry* is entirely based on this explanatory principle. All chemical reactions are regarded as a result of motion and collision of particles. However, it remains a mystery how elastic collision can engender a new compound - for instance, how it is possible that two gas molecules, which collide elastically, can, nonetheless, unite and build a new gas molecule that is composed of the two colliding molecules. This example illustrates the absurdities that arise from the concept of elastic collision.

As external observers we experience the aggregated product of this energy exchange as an increase in volume of material systems and assess it by temperature. In this particular case, temperature is inversely proportional to the energy of the levels of particles  $T \approx 1/E_{particles}$  and proportional to the liberated amount of energy from these levels, which is manifested as an increase in the kinetic energy of the thermodynamic level  $K_{av} \approx T$  (Boltzmann's law). This interaction demonstrates the reciprocal behaviour of the LRC of contiguous levels in a system - the system being a material object.

From this novel presentation of thermodynamics, it becomes evident that as soon as the various levels of matter and their quantities are clearly defined from an epistemological point of view, we automatically come to the conclusion that the reciprocity of space and time is not infringed at the thermodynamic level. Throughout this discussion, we should always keep in mind that all levels of space-time, respectively, matter, are U-subsets that contain themselves as an element, so that they cannot be distinguished in real terms but only in an abstract way in the mind. This new interpretation of the kinetic theory of gases in the light of the new axiomatics affects another great simplification in our view of the physical world.

*Exercises:*

1. Express the **root mean square speed**  $v_{rms} = \sqrt{\frac{3k_b T}{m}} = \sqrt{\frac{3RT}{M}}$  in the new space-time symbolism. Discuss why this equation is identical with the formula of the *speed of sound* in gas  $v_{sound} = \sqrt{\frac{\gamma RT}{M}}$ , where  $\gamma = 1.4$  for air. Show that the kinetic thermodynamic level and the sound level of gases are U-subsets of matter to which the principle of superposition applies, e.g. superimposed waves.
2. Discuss the statistical approach of Boltzmann in physics. Work out the logical blunders that have led to the idea of *increasing entropy* (see chapters 5.6 and 5.7).
3. Show that **van der Waals equation** of real gases is an application of the Universal Law. Discuss the *liquid-vapor isotherms* as a paradigm of distinct levels of space-time. Use the same approach to explain the *phase diagrams* of *vaporation* and *sublimation*.
4. Show that **Dalton's law (law of proportions)**, saying that the presence of other gases does not alter the partial pressure of any given gas, is an intuitively correct perception of the nature of space-time.
5. Prove that *relative humidity* is absolute time. Discuss the building of *percents* in the light of the Universal Law.

## 5.4 HEAT AND THE FIRST LAW OF THERMODYNAMICS (ND)

„**Heat** is energy that is transferred from one object to another because of a difference in temperature.“<sup>136</sup> From this quotation we learn that thermodynamics considers heat as a specific level of energy exchange that is based on a *temperature gradient*. The history of thermodynamics resembles a gangway to Canossa paved with epistemological blunders that are paradigmatic for the rest of physics. It began with ancient Thracian atomists who considered heat a manifestation of molecular motion. Galilei, Newton and other scientists supported their theory. This triggered the development of a **caloric theory**, which was quite successful for a while. This theory regarded heat as an invisible fluid, called “*caloric*“, that was neither created nor destroyed, but merely flowed as a conserved material substance from one material object into another. The intuitively correct idea of energy (space-time) was projected on heat, which is a level thereof. The flaw in the caloric theory was that it considers heat a closed entity which does not participate in an energy exchange with other levels.

This assumption was first questioned by *Benjamin Thompson*. He suggested that heat is not a substance that is conserved, but rather some kind of *motion* that is communicated from one body to another. He showed that the heat produced was approximately proportional to the *work* done. This led to the development of the modern *mechanical theory* in the late 1830s initiated by the experiments of *James Joule*, after whom the SI unit of energy is named. This theory considers **thermal energy** (= heat) as the “*internal energy*“ of a system. In its view, heat energy is transferred from one object to another because of difference of temperature  $\Delta T = \Delta f = SP(A)$ .

It is, indeed, impossible to perceive why the new mechanical theory should be a further development of the caloric theory. In fact, it does not enlarge our knowledge, but disguises the epistemological misery of this branch of physics by introducing new quantities of space-time, such as temperature. In addition, the pleonasm “thermal energy = internal energy of material object“ has led to grievous cognitive failures that have precluded the appropriate understanding of the nature of energy (space-time). We pay special attention to this issue, as heat is paradigmatic of the primary term. The **first law of thermodynamics** is a *law of conservation of energy* - although it is rooted in basic inconsistencies, it is still the most adequate perception of the Universal Law that has been developed so far.

Before we discuss the first law of thermodynamics, we shall introduce some basic quantities of this discipline and show that they are iterations of known quantities in classical mechanics. We begin with an elaboration of the

---

<sup>136</sup> PA Tipler, p. 517

real connotations of the basic terms, “heat“, “thermal energy“, “internal energy“ and “thermodynamic, kinetic energy“. These quantities are totally confused by present-day thermodynamics. “Heat“ and “thermal energy“ are used as synonyms, while “internal energy“ is a synonym for the kinetic energy of the thermodynamic level, which is assessed by Boltzmann’s law (73a). “Heat“ is the *amount of thermodynamic, kinetic energy* that is exchanged between two objects or within an object, for instance, in a rod that exhibits a difference of temperature at the two ends.

The metaphysical character of the thermodynamic level makes heat an adequate paradigm of energy exchange at the level of matter. This is the **substantial** view of classical physics. With the development of electromagnetism and quantum mechanics, this specific level of matter has been substituted by the photon level, so that photon energy has now become a synonym for energy. This view culminates in Einstein’s equation of energy  $E = mc^2$ , which claims universal validity and is basic to his theory of relativity. In Einstein’s view, the term “energy“  $E$  is equivalent to photon energy ( $c^2$ ), while the term “mass“, being a simple relationship of energy  $m = SP(A)$ , is comprehended as a substitute for matter (see the calculation of rest mass and binding energy of hadrons in chapter 7.4, 2. example).

Heat energy  $Q$  (should not be confused with charge  $Q$ , ambiguity of physical symbolism) is defined as the amount of exchanged energy that is needed to raise the temperature of a substance  $Q \approx T = E \approx f$ . When we build a quotient of space-time and time according to the principle of circular argument, we obtain the action potential:  $Q/T = C = E/f = E_A$ , or  $C = E_A$ . This is an application of the universal equation. The new quantity  $C$  is called **heat capacity**. It is defined as the amount of heat energy needed to raise the temperature of a substance by one degree: if  $T = f = SP(A) = 1$ , then  $C = E_A f = E_A$ . We come across the universal procedure of building new quantities of space-time by employing the number “1“ as the universal symbol of space-time or a quantity thereof. In a vicious circle, another basic quantity is obtained - the **specific heat**  $c$ . It is defined as the heat capacity per unit mass:  $c = C/m = C/K_s = E_A/K_s = SP(A) = f$  or  $C/c = m = SP(A)$ . By employing these quantities, the space-time of **heat** is expressed as follows:

$$Q = CAT = mc\Delta T = E = E_A f \quad (75)$$

This equation is equivalent to *Boltzmann’s law* and is an application of the Universal Law. The historical unit of heat energy is the **calorie**. It is arbitrarily defined as the amount of heat needed to raise the temperature of one gram of water one Celsius degree. This definition demonstrates the validity of the basic statements of our axiomatics. We can voluntarily select the energy of a real system  $Q = CAT = E_A f$  and assign it the number “1“ by defining its time  $\Delta T = f = SP(A) = 1$  as the certain event or 1 *unit*:  $Q = C = E_A = 1$  *calorie*. The term “1 *calorie*“ is a synonym for the energy of an arbitrarily chosen thermal

system that is regarded as a constant action potential. It can be substituted by any other action potential by employing a conversion factor, for instance, by the SI unit  $1 \text{ joule} = 1 \text{ calorie}/4.184$ , or  $1 \text{ joule}/1 \text{ calorie} = E_{\text{joule}}/E_{\text{cal}} = SP(A) = 1/4.184$ . The measurement of energy in terms of the SI unit “1 joule” is an intuitive perception of the fact that space-time is inhomogeneous. When we say that the energy of each particular system is “ $n \text{ joules}$ ”, we, in fact, mean that its energy is equivalent to its time  $E=f$ , as  $E_A = \text{joule} = 1$ . This is simple mathematics applied to the physical world. Precisely for this reason, its epistemological background has been grossly overlooked in present-day physics.

Thermodynamics has introduced the method of **calorimetry**, with which the **energy balance** of thermic exchange is measured. This is an experimental method confirming the conservation of energy for the level of heat  $Q_{\text{out}} = Q_{\text{in}}$ . This approach anticipates the novel input-output model of the universe, with which vertical and horizontal energy exchange between levels and systems can be adequately assessed (chapter 9.9). This model is equivalent to the continuum:  $Q_{\text{out}}/Q_{\text{in}} = SP(A) = n$ . In volume III, we shall apply this method of measurement to calculate the *energy balance* of **human organism** and **cells**, thereby proving that the effective chemical energy of nutrition set free by cell metabolism is completely transformed into the electromagnetic energy of membrane potentials of cells (chapter 1.2). During a **cellular action potential**, the electromagnetic energy of the *resting membrane potential* is completely transformed into the biochemical, structural energy of the cell (into the intracellular compounds) and vice versa. This energy exchange is responsible for the existence of organic life - from the most primitive species, such as prokaryotes to the most complicated multicellular organisms, such as the human body - this energy pattern is invariant.

The exchange of heat also includes the **change of phase**, which is a circumlocution for the building of new contiguous levels as a result of this energy exchange. Types of phase changes are *fusion* (the change of a liquid to a solid), *vaporization* (the change of a liquid to a vapor or gas) and *sublimation* (the change of a solid to a gas). The **latent heat of phase change  $L$**  is a constant amount of energy that is specific for any system and type of phase change (type of energy exchange):  $Q/L = m = SP(A)$ .

According to thermodynamics, thermal energy is transferred from one place to another by three processes: **conduction**, **convection** and **radiation**. The first two terms describe the particular energy exchange between systems of matter; the third one describes the vertical energy exchange between matter and photon space-time. Radiation is assessed by two distinct laws - **Stefan-Boltzmann law** and **Wien's displacement law**. Both laws are concrete applications of the Universal Law for this particular energy exchange (see chapter 5.5). Conduction and convection are imprecise descriptive terms of anthropocentric origin. While conduction is reserved for heat transfer within a body without visible mass transport, convection circumscribes heat transfer by

direct mass transport. The discrimination between the two terms is arbitrary and highly subjective. In fact, both terms are synonyms for the horizontal energy exchange between systems of matter.

Conduction and convection are described by a number of quantities that are similar to those of electromagnetism. The rate of change in temperature along the distance of an object is called the **temperature gradient**  $\Delta T/\Delta x = f/[1d\text{-space}]$ . This quantity is of the same character as density (47) or pressure (68). It is a quotient of the two constituents of the thermal system, space and time (principle of circular argument). The quotient of thermal energy (heat)  $\Delta Q$  and conventional time  $\Delta t$  is called the **thermal current**  $I = \Delta Q/\Delta t$ . This quantity is the product of a vicious circle that is typical for most physical definitions. It says: "If  $\Delta Q$  is the amount of thermal energy conducted through the section (of an object) in some time  $\Delta t$ , the rate of conduction of thermal energy  $\Delta Q/\Delta t$  is called the **thermal gradient**  $I$ . Experimentally, it is found that the thermal current is proportional to the temperature gradient and to the **cross-sectional area**  $A$ .<sup>137</sup>:

$$I = \frac{\Delta Q}{\Delta t} = kA \frac{\Delta T}{\Delta x} = SP(A)[2d\text{-space}]f = E_A \quad (76)$$

The hidden method of this definition is geometry. It involves the classical paradigm of considering space-time statically as *structural complexity*  $E = K_s = SP(A)[2d\text{-space}]$  when  $f = SP(A) = 1$ , which is then described as a cross-sectional "area in motion" (point 46.). The paradigm " **$K_s$  in motion**" demonstrates the transitivity of the new axiomatics: we can depart from the primary term of space-time and obtain geometric structures (in most cases as *area*) or vice versa; we can depart from the concept "area in motion" and obtain space-time by introducing the constituent time  $f$ , which represents the dynamic character of the primary term. This hidden method of definition becomes cogent when it is used as a method of measurement - in the case of the thermal gradient, the area in motion is defined as the cross-sectional area of the object, through which the hypothetical thermal energy is flowing. What one measures in reality is, however, not the thermal energy  $\Delta Q$ , but its rate of conduction through the cross-section  $A$  of the conducting object in the time  $\Delta t$ :  $I = A/\Delta t = SP(A)[2d\text{-space}]f$ , where  $SP(A)$  stands for  $\Delta$ .

The definition of thermal current is identical to the definition of **electric current**  $I$ , as the name and symbol suggest. Like the thermal energy  $\Delta Q$ , *electric charge* is also expressed as area:  $Q = \text{area} = K_s = SP(A)[2d\text{-space}]$  (see chapter 6.2). Therefore it is no coincidence that physicists have resorted to the same symbol for thermal energy and charge -  $Q$ . Indeed, the reader need not resort to a couch to perform a deep Freudian analysis of the physicist's mind in order to understand the subconscious labyrinth of conventional definitions

---

<sup>137</sup> PA Tipler, p. 525

and symbols of this “exact“ natural science. The new axiomatics is Ariadne’s thread that will help him escape from this linguistic labyrinth of physical definitions.

Everything we have already said about the electric current, also holds for the term, **thermal resistance**  $R = \Delta x/kA$ , which is equivalent to *electric resistance*  $R$ . We leave the proof to the reader (see exercise 1. below). Physics can be an open book, as soon as we organize our mind and look upon nature, that is, upon space-time, in an axiomatic manner - the Universal Law, the Logos, is applied logic.

The first law of thermodynamics is a statement of the conservation of energy (space-time). Its principal flaw is to project this property of the primary term to its U-subset “heat“ or “thermal energy“. The whole is defined through the part. This creates a paradox with respect to the second law. The first law says: “The net heat added to a system equals the change in the internal energy of the system plus the work done by the system.“<sup>138</sup> As already pointed out, by “internal energy“ one means the average kinetic energy of the mol-level  $\Delta U = K_{av}$  (see equation (73a)). The **work** is expressed by the *law of Gay-Lussac* (70):

$$Q = \Delta U + W = K_{av} + dW = 3/2nRT + PdV = E_A f \quad (77)$$

Depending on the geometric method of measurement, one acquires different values for the numerical quotient of Boltzmann’s law for the internal energy of *gases* ( $U = 5/2nRT$ ) and *solids* ( $U = 3nRT$ ). The first result is obtained from the so called **equipartition theorem** of gases, while the second result is known as **Dulong-Petit law**. According to the latter law, the **molar heat capacity**  $C_m = Mc$  of most metals is approximately  $C = 3R = 24.9 \text{ j/mol}\times\text{K}$ . We shall use this result to prove that the thermodynamic level is an open level that participates in an incessant energy exchange with the levels of particles. In this way we shall confirm the new interpretation of the kinetic theory of gases (chapter 5.3).

Thermodynamics does not explain why the internal energy of material systems should be set equivalent to the kinetic energy of the thermodynamic level, which is just one of the infinite levels of matter, while at the same time the much greater energy of the levels of particles is completely neglected. This flaw stems from the deterministic approach in physics. However, as all levels of space-time are U-subsets, the thermodynamic level contains the underlying levels of particles as an element. The reason is that this level exchanges energy with the particle levels and its space-time can change relatively from one object to another or relativistically within the object. Depending on the amount of energy exchanged, the overall effect that can be observed is

---

<sup>138</sup> PA Tipler, p. 537

either **expansion** or **contraction** of space as assessed by the change of volume in thermal systems. These changes in space are assessed by the temperature, which is a particular quantity of time for this level. Expansion and contraction are thus macroscopic events that are measured in thermodynamics and can be transformed into work by **heat-engines**.

Thermal expansion or contraction of material systems always involves the vertical energy exchange with the photon level as it is also an U-subset of space-time. We postulate in our aximatics that energy exchange is vertical and horizontal at once. Therefore, there is no difference between the transport of heat and the propagation of gravitation - both levels of space-time are involved in the vertical energy exchange between matter and photon space-time and obey the Universal Law. This is another fundamental proof that space-time is a unity.

This will be proven for metals. According to Dulong-Petit law, the **molar heat capacity**  $C_m$  of most metals is almost *constant* at high temperatures:

$$C_m = 3R = 3k_b N_A = Mc \quad (78)$$

We shall now prove that the **specific heat**  $c = C/m = f$  of each metal is a function of the energy of the particle levels and the photon level. For this purpose we depart from equation (46b), which is an application of the universal equation for the mol-level and substitute Avogadro's number with the following formula as obtained from (78):  $N_A = Mc/3k_b$ :

$$M = m_p (n_{pr} f_{c,pr} + n_n f_{c,n} + n_e f_{c,e}) \frac{Mc}{3k_b} \quad (79)$$

This equation considers all elementary particles in the atom, such as electrons, protons and neutrons;  $n$  gives the number of particles in the atom. We can eliminate the molar mass  $M$  and solve the equation for the **specific heat**:

$$c = \frac{3k_b}{m_p (n_{pr} f_{c,pr} + n_n f_{c,n} + n_e f_{c,e})} = \frac{E_{A,thermo}}{E_{A,particles}} = SP(A) = K_{1,2} \quad (79a)$$

Equation (79a) is the universal equation as a rule of three applied to the vertical energy exchange between the microscopic thermodynamic level with the **molecular action potential**  $E_{A,thermo}=(3)k_b$  and the kinetic energy  $K_{av}$ , and the levels of the particles with the **aggregated action potential**:  $E_{A,particles} = m_p n_{particle} f_c = m_p f = K_s f = SP(A)[2d-space] f$ . The outstanding result of this new application of the Universal Law is that the specific heat of each material system is a function of the mass (energy relationship) of the *basic photon*  $m_p$  -  $c$  is inversely proportional to  $m_p$ . This result proves that the

magnitude of the thermal energy measured by  $c$  behaves reciprocally to the energy (relationship) of photons measured by  $m_p$ . We obtain again the reciprocal character of the LRC of two contiguous levels, matter and photons, during their vertical energy exchange. This conclusion will be substantiated by further derivations in chapters 5.5 - 5.7.

*Exercises:*

1. Determine the dimensionality of the *constant*  $k$  from the equation of the thermal current (76). Discuss this quantity in the light of the new axiomatics.
2. Present *thermal resistances in series* and *in parallel* in the new space-time symbolism and discuss these quantities in comparison with the electric resistances in series and in parallels. Repeat the same for the *thermal conductivity*.
3. Discuss the method of definition and measurement of the *equipartition theorem* and *Dulong-Petit law*. Explain why their application is restricted. Analyse the basic term of the equipartition theorem “*degree of freedom*“ from an epistemological point of view. Work out the difference between this term and the new term “**degree of mathematical freedom**“. Discuss both terms with respect to the philosophical concept “*freedom of the will*“. Explain why this term is basic to the idea of direct democracy (through plebescites) and leads to the rejection of mediators - of priests in religion and politicians in the regulation of society.

## 5.5 LAWS OF RADIATION (ND)

As already said, heat is transferred by conduction, convection and radiation. The first two processes describe the horizontal exchange of heat between material systems, while **radiation** is a synonym for the vertical energy exchange between matter and photon level. Thermodynamics has elaborated two distinct *laws of radiation* - **Stefan-Boltzmann law** and **Wien’s displacemet law**. We shall show that these laws are equivalent derivations within mathematical formalism and are thus concrete applications of the Universal Law. We begin with **Stefan-Boltzmann law**. It says that the rate at which an object radiates thermal energy is proportional to the area of the object and to the fourth power of its absolute temperature:

$$P = e\sigma AT^4 = E \quad (80),$$

where  $P$  is the **power of radiation**,  $A$  is area,  $e$  is **emissivity** of the object and  $\sigma$  is a universal constant, called **Stefan’s constant**. Stefan-Boltzmann’s law is a solution of the universal equation for the quantity *power* (14). The *emissivity*  $e$

is a numerical relationship that varies from 0 to  $1 = SP(A)$ . This law is often presented as an input-output law:  $P = e\sigma A(T^4 - T_o^4)$ , where  $T_o$  is the temperature of the surroundings. This expression acknowledges the fact that radiation is a vertical energy exchange between matter and photon level that occurs in both directions. It also gives rise to the idea of an **ideal blackbody** that absorbs all the radiation incident upon it. The theoretical emissivity of this *closed* system of abstraction should be  $e = 1$ , which is an iteration of the certain event.

An ideal blackbody is an intuitive perception of the closed character of space-time that is projected onto a material system (U-subset). According to the principle of last equivalence, the idea of a blackbody is a prerequisite for the definition of the laws of radiation, which are particular applications of the universal equation for the vertical energy exchange between matter and photon space-time. The conventionally thinking physicist as embodied by P. A. Tipler must have intuitively felt this truth: “The concept of an ideal blackbody is important because the characteristics of the radiation emitted by such an object can be *calculated theoretically*.”<sup>139</sup> What the author really means is that any physical law is a mathematical equation, and any equation is an application of the principle of last equivalence for the parts (principle of circular argument). There is no exception to this principle.

Stefan-Boltzmann law illustrates the degree of mathematical freedom that allows us to express the Universal Law by different formulae. Such equations evoke the wrong impression that nature is infinitely complicated. In fact, this is only true for mathematics. Stefan-Boltzmann law of radiation is of the same origin as Boltzmann’s law of kinetic energy - for each system of radiation with a constant space-time, that is,  $e\sigma A = cons.$ , the energy of radiation depends only on the temperature  $P \approx T^4$ . The same holds in Boltzmann’s law of kinetic energy  $K_{av} \approx T$ . The fourth power of  $T$  is without relevance - according to the new axiomatics, space-time or its constituents can be expressed  $n$ -dimensionally, respectively, at the  $n$ -power, without affecting the validity of the primary axiom (principle of last equivalence, see also equation (25-4) and point 25.). We shall confirm this axiomatic conclusion by explaining the ontology of Stefan-Boltzmann law from our mathematical consciousness.

This law assesses the power of the emitted photons. In this case, “power” is an abstract meta-level of the photon energy  $E_p$  that is expressed as a function of time  $f = 1/t$ :  $P = E_p f$ . For didactic purposes, we shall present the different time quantities nominalistically with  $f$ , although they may have a different magnitude. The actual energy of photons is given by Planck’s equation  $E_p = hf$ . From this equation, we write for the power  $P = hf^2$ . The Planck’s constant, called the basic photon in the new axiomatics, can be expressed as follows:  $h = m_p c^2 = m_p \lambda_A^2 f^2 = SP(A)[2d-space] f^2$ . When we

---

<sup>139</sup> PA Tipler, p. 531

set the basic photon from the above formula in Stefan-Boltzmann law, we obtain the exact dimensionality of the parameters used in this law:

$$P = e\sigma A T^4 = m_p \lambda_A^2 f^4 = SP(A)[2d\text{-space}] f^4 = K_s f^4, \text{ where } T=f \quad (80a)$$

From this equation, one can easily obtain the dimensionality of the three parameters of Stefan-Boltzmann law:  $e = SP(A)$ ,  $\sigma = SP(A)$  and  $A = [2d\text{-space}]$ . The term  $K_s = e\sigma A = SP(A)[2d\text{-space}]$  gives the constant space-time of the system of radiation as an area. These quantities belong to the emitted system of matter, but they can also be derived from the structural complexity of the basic photon  $K_s = m_p \lambda_A^2$ , when the universal equation is applied (principle of circular argument). We leave this exercise to the reader.

We obtain the same result when we depart from **Wien's displacement law**. This law determines the **wavelength** of the *emitted* photons, at which the *maximum* power is observed:

$$\lambda_{max} = \frac{B}{T}, \text{ hence } B = \lambda_{max} T = [1d\text{-space}] f = [1d\text{-space-time}] = v \quad (81)$$

We gather from equation (81) that **Wien's constant of proportionality  $B$**  is one-dimensional space-time of matter, that is, velocity. At present, this law is very poorly understood. Especially the importance of the constant  $B$  has been overlooked. We shall correct this mistake. When we set  $\lambda_{max} = B/T$  from Wien's displacement law in the formula of the speed of light  $c = \lambda f$ , and present it as a rule of three, we can show that  $B$  is a velocity:

$$\frac{c}{f} = \frac{B}{T} = \frac{[1d\text{-space-time}]}{f} = [1d\text{-space}] = \lambda_{max} \quad (81a)$$

The **constant  $B$**  is one-dimensional space-time of a **novel material level of thermodynamics** that has evaded the attention of physicists. As an U-subset of matter, this level contains the thermodynamic, kinetic level of the molecules as an element. This level determines the space-time of the emitted photons, that is, their wavelength (space) and frequency (time) with respect to temperature, which is a quantity of material time. When we solve equation (81a) for the frequency of the emitted photons at which the maximum power is observed, we obtain a **new constant** of fundamental importance in cosmology:

$$f_{max} = (c/B)T = K_{CBR}T = SP(A)T = 1.0345 \times 10^{11} \times T \quad (82)$$

The new constant of proportionality  $K_{CBR} = c/B$  is an absolute constant, as both  $c$  and  $B$  are one-dimensional space-time (velocities). We call it the **constant of the cosmic background radiation, CBR**, and use the symbol  $K_{CBR}$ .

We shall show in cosmology that with the help of this constant we can easily calculate the frequency of the maximal power of cosmic background radiation. This result is confirmed by latest data from COBE-telescope. This is another example proving that we do not need expensive research to explore nature. All we need is an axiomatic organization of known data. This is the objective of the present tetralogy of science. As space-time is a closed, inter-related entity, we can acquire all necessary information about the universe from established magnitudes of space and time (constants) that can be easily measured in local experiments. This insight will revolutionize science and streamline research.

Although we call  $K_{CBR}$  a constant of cosmic background radiation, it holds in any kind of radiation. We have chosen this particular name because  $K_{CBR}$  helps us to refute the “big bang“ hypothesis and the *standard model* of cosmology postulating the expansion of the universe (see section 9). In the standard model, CBR is considered a remnant of the big bang and is regarded a key evidence for the expansion of the universe. Based on this constant, we can interpret Stefan-Boltzmann law in terms of knowledge. When we solve equation (82) for the temperature  $T = f_{max}/K_{CBR}$  and substitute this quantity in Stefan-Boltzmann law, we obtain the **power** of the emitted photons as a function of their *frequency (time)*:

$$P = \frac{e\sigma A}{K_{CBR}^4} f_{max}^4 \quad (83)$$

This is already known from Planck’s equation  $E = hf$ . From the two laws of radiation, the novel **Stankov’s law of photon thermodynamics** will be derived in chapter 5.7. As with all previous laws, it is an application of the Universal Law. We shall use this law to refute the wrong idea of “growing entropy“, as postulated in the second law of thermodynamics. For this purpose, we shall first discuss the second law of thermodynamics in the next chapter.

## 5.6 ENTROPY AND THE SECOND LAW OF THERMODYNAMICS (ND)

The **second law of thermodynamics**, also called the “**law of entropy**“, is a consequence of the first law - or more precisely, it is a consequence of the flaws committed by the formulation of the first law. The definition of conservation of energy departs from heat and involves the anthropocentric term “work“ (see equation (77)). This highly subjective definition of the first law has inevitably produced a collection of ideas that have obscured thermodynamics. The anthropocentric idea of “work“ is intrinsically linked to the notion of the “**availability of energy**“, which is basic to the second law:

“...The first law does not tell the whole story. Energy is always conserved, but some forms of energy are *more useful* than others. The possibility or impossibility of putting energy to *use* is the subject of the second law of thermodynamics.”<sup>140</sup>

This quotation should be sufficient to reject the second law and discredit physics as an objective science that is independent of human prejudices, as physicists would like to see it<sup>141</sup>. The idea of “usefulness“ of energy may play a role in production (as mechanical work), but never in theoretical science. The human experience is that it is easy to convert mechanical work or the internal energy of a system ( $K_{av}$ ) completely into heat with no other changes, but it is impossible to remove heat or internal energy from a system and convert it completely into mechanical work with no other changes. The reason for this is that energy exchange at the thermodynamic level is open and involves all levels of space-time. In the first place, it is a vertical energy exchange between matter and photon space-time as demonstrated by the two laws of radiation. Only when this process is regarded unilaterally from the point of view of matter does it give the impression of being “irreversible“. This is the subjective view of conventional thermodynamics:

„There is thus a *lack of symmetry* in the roles played by heat and work that is not evident from the first law. This lack of symmetry is related to the fact that some processes are *irreversible*... This experimental fact is one statement of the second law of thermodynamics.”<sup>142</sup>

Motion with **kinetic friction** is an example of this irreversibility of heat exchange. If there were no friction, we might be able to develop a *perpetuum mobile* (= space-time). The story is old and, as with most familiar issues, it

---

<sup>140</sup> PA Tipler, p. 563

<sup>141</sup> This was precisely what Einstein believed - he was convinced that physical laws exist independently from consciousness and preached its elimination in physics as a source of subjectivity. This attitude prevented him from discovering the “universal field equation“, which he searched in vain during his whole life. The elimination of consciousness is, indeed, the rigid doctrine of modern physics that is manifested as an “acquired intellectual deficiency syndrome“ (physical AIDS) by all representatives of this discipline who have substituted the quest for knowledge with simple conformism. This attitude has become a pandemic during the twentieth century, but as epidemiology teaches us, the life-cycle of a pandemic ends up with its maximal expansion: when [space]→∞, time→0. This is the Universal Law in operation. In religion, it is sometimes mistaken with “divine justice“. The rapid decay of the communist system after its maximal expansion is a typical example that will be followed by a similarly rapid decay of the so called “free“ market economy. These collapses result from the systemic neglect of the Universal Law at all levels of collective and individual thinking and action.

<sup>142</sup> PA Tipler, p. 563

has been profoundly misapprehended. The preoccupation of physics with heat has one simple reason: most of the power engines used at present are *heat engines* based on the **combustion** of gas, coal and fuel, that is, the bulk of the energy that is available to us today is obtained from the burning of organic matter, which is a product of **photosynthesis**<sup>143</sup>. Both terms, combustion and photosynthesis, describe the energy exchange between matter and photon level that takes place in both directions. Photon energy from the sun is the primary source of building organic matter, such as plants. Thus, photosynthesis stands for the energy conversion from photon space-time to organic space-time. Plants are the origin of gas, coal and fuel. In particular, they have enriched the atmosphere with oxygen through photosynthesis and have thus created favourable conditions for the development of animals and human beings with consciousness. With the rise of capitalism about 200 years ago, man - this final product of organic evolution - is about to consume (with the help of physics and applied science) within a short period of time the stored organic energy of photosynthesis that has been collected during an evolution period of estimated 4 billion years.

From this elaboration, we conclude: most of the energy now available to mankind is mainly heat (thermal energy), which is gained from the combustion of the structural organic energy created by photosynthesis. When thermal energy is used by humans, most of the heat is **radiated** as photons (Stefan-Boltzmann law, Wien's displacement law), and only a small portion of it is transformed into work. The portion of thermal energy that is converted into photon energy is defined as **lost work**  $W_{lost}$ . Exactly this irreversibility of available energy from the human point of view is the topic of the second law of thermodynamics. It begins with the elucidation of the **efficiency** of thermal energy with respect to work:

$$\epsilon = \frac{W}{Q_h} = \frac{Q_{hot} - Q_{cold}}{Q_h} = \frac{dQ}{Q_h} = \frac{dE_{thermal}}{E_{available}} = SP(A) \quad (84),$$

where  $dQ$  is called the **heat reservoir**. The **efficiency**  $\epsilon$  is a *coefficient* of the horizontal heat exchange between the systems of matter. As space-time exchange always involves a horizontal and a vertical exchange, this coefficient is, in fact, a function of the energy exchange between matter and photon space-time. As we are still not in the position to use the energy of photon space-time for mechanical work in heat engines, the portion of thermal energy that is transferred from matter to photon level by radiation is virtually lost for practical purposes. If we assume that there is no vertical energy exchange

---

<sup>143</sup> When atomic energy serves as a primary source of convertible electric energy (less than 20% worldwide), this energy is used to a large extent in the industrial production of heat engines, e.g. motors for cars or other machines that are based on combustion. At the end of the cycle we always have a burning of organic matter.

between matter and photon space-time by radiation, we get for the efficiency  $\epsilon = 1$  (closed system). This is, however, impossible. This experimental result is known as the **Kelvin-Planck** or **heat engine statement of the second law of thermodynamics**: “It is impossible for a heat engine working in a cycle to produce no other effect than of extracting heat from a reservoir and performing an equivalent amount of work.”<sup>144</sup>

There are many variations of this statement that obscure thermodynamics. A very popular definition is the “**refrigerator**” **statement** of the second law of thermodynamics: “It is impossible for a refrigerator working in a cycle to produce no other effect than the transfer of heat from a cold to a hot object.”<sup>145</sup> The reader may figure out how many statements of the second law are possible when one considers all heat engines, which we use in daily life. This example underlines our initial conclusion that the second law of entropy is a **subjective** interpretation of the first law of conservation of energy with respect to work.

The logical consequence of this subjective view in thermodynamics is the formulation of the **Carnot theorem**: “No engine working between two given heat reservoirs can be more efficient than a *reversible* engine working between those reservoirs.”<sup>146</sup> From the Carnot theorem, the **Carnot engine** has been developed - unfortunately, not in the real world, but in the imagination of physicists<sup>147</sup>. The concept of Carnot engine is another version of a closed system as an intuitive notion of the closed character of space-time. The primary axiom is vested in all physical concepts.

While the ideal Carnot engine is not in a position to produce energy, it has generated a collection of concepts of an abstract mathematical character. We have shown that it is a privilege of our consciousness to define abstract quantities of space-time within mathematics. For instance, the space-time magnitudes of levels and systems can be determined in a quantitative manner only by

---

<sup>144</sup> PA Tipler, p. 567

<sup>145</sup> PA Tipler, p. 568

<sup>146</sup> PA Tipler, p. 569

<sup>147</sup> The most ridiculous trait of the conventionally thinking physicist is his honest belief in the “objectivity” of his science. This conviction stems from his professional loss of perception for the real world. The link to reality is systematically repressed during physical education. As physics is applied mathematics (a system of objects of thought), students of physics are trained from the very beginning to substitute the real object of their study, space-time, respectively, energy, with a mathematical surrogate thereof without being made aware of this fact. In classical mechanics, this surrogate is Euclidean space, which is the universal geometric frame of any definition or description of physical quantities. Classical geometry remains the preferred surrogate of space-time in wave theory, thermodynamics and electromagnetism. The development of quantum mechanics became possible only after Riemann generalized geometry to take account of different topological spaces. Modern physical theories evolve around further developments of mathematical tools, with which scientists have substituted real energy which is the only true object of their study. It goes without saying that this approach precludes a genuine knowledge of nature.

arresting time in the mind, that is, by arresting energy exchange for the sake of comparison (principle of circular argument). This is accomplished by the use of abstract mathematical symbols, such as “1“ for the certain event or 1 *unit*, for the constituent “time  $f$ “. In the Carnot engine, one distinguishes between an **isothermal** process ( $T = f = \text{cons.} = 1$ ), which leads to *expansion* or *compression* of the space-time of material systems when pressure ( $E$ ) decreases or increases, and an **adiabatic** process ( $P \approx E = \text{cons.} = 1$ ), which also causes an expansion or compression when the temperature changes. The isothermal and adiabatic expansion or compression are ideal states of the thermal system that intuitively reflect the reciprocity of space and time, respectively, of space and energy, for the level of matter. These states are introduced for didactic purposes and have the same explanatory function as the kinetic and potential energy in classical mechanics. They allow an assessment of space-time in a dualistic, that is, dynamic and static way. In reality, energy exchange is an interrelated motion - any thermal energy exchange leads to simultaneous changes in both temperature (time) and pressure (energy), and, subsequently, in space (volume). Space-time is the only real thing, while all quantities are abstract U-subsets of the primary term. For this reason we can only consider these quantities as abstract entities in the mind and modulate them for didactic purposes (degree of mathematical freedom). This is the actual meaning of the Carnot theorem, of which the Carnot engine is a virtual realization.

The Carnot engine is used to determine the optimal efficiency of a heat engine with respect to work. In this calculation, the energy exchanged with the photon level is totally neglected - it is regarded as “irreversible“ and “completely lost“. When the actual efficiency of an existing heat engine is compared with the theoretical efficiency of the ideal Carnot engine, the relative efficiency of the heat engine is determined. This is called the **second law of efficiency**:

$$\epsilon_{SL} = \epsilon / \epsilon_C = SP(A)$$

The **law of entropy** (second law of thermodynamics) is the generalized form of this human experience with respect to heat: “All irreversible processes have one thing in common - the system plus its surroundings moves towards a **less ordered** state.“<sup>148</sup> The immediate question that this statement should evoke is: “What is the meaning of the term “surroundings“? The answer of thermodynamics to this question is turned upside down: “By “universe“, we mean the system plus its surroundings.“<sup>149</sup> When we translate this statement into logical terms:

$$\text{system} + \text{surroundings} = \text{universe} = \text{thermal energy} + \text{energy} =$$

---

<sup>148</sup> PA Tipler, p. 577

<sup>149</sup> PA Tipler, p. 579

= *space-time = mathematical symbols,*

we obtain the primary axiom of our axiomatics according to the principle of last equivalence. Unfortunately, thermodynamics, in particular, and physics, in general, have failed to define the primary term. This omission has given rise to the second law. It is said to be a law of entropy. But what is entropy? We read in the literature that “there is a thermodynamic function called **entropy**  $S$  that is a measure of the “disorder“ of a system.”<sup>150</sup> Evidently, entropy is a synonym for **disorder**. “But what is disorder?“, should be our next question. To this we read:

“Like the pressure  $P$ , volume  $V$ , temperature  $T$ , and thermal energy  $U$ , entropy is a function of the state of a system. As with internal energy, it is the **change** in entropy that is important. The **change in entropy**  $\Delta S$  of a system when it goes from one state to another is defined as

$$\Delta S = \int \frac{dQ_{rev}}{T} = SP(A)[2d - space]f = E_A \quad (85),$$

where  $dQ_{rev}$  ( $dQ_{rev} = E = SP(A)[2d - space] = K_s$ , when  $f = 1$ ; see thermic current (76)) is the heat that must be added to the system in a *reversible* process to bring it from its initial state to its final state.<sup>151</sup>

From this definition, it is cogent that the conventional term “entropy“ departs from “disorder“, which is the most obscure connotation ever introduced in physics, and ends up with the primary term: entropy is defined as the “change in energy per time“ with respect to the U-subset “heat“:  $dQ_{rev} = \Delta ST = E_A f = E$ . The latter is a clear-cut mathematical definition, which is also the method of measurement of the quantity “entropy“. The universal event of energy exchange is the action potential. Thus,

the “**change in entropy**“ is per definition an *action potential* of the *thermodynamic level* :  $\Delta S = E_A$ .

This is an axiomatic conclusion from the above definition that will be substantiated by the various mathematical expressions of the law of entropy. All of them depart from the first law of thermodynamics as presented in equation (77) and are thus mathematical iterations of the Universal Law. We shall skip their method of derivation, which is mathematics (geometry, algebra and theory of probabilities), and shall only write the final results:

<sup>150</sup> PA Tipler, p. 577

<sup>151</sup> PA Tipler, p. 577

$$\Delta S = C_p \ln \frac{T_2}{T_1} (1) = nR \ln \frac{V_2}{V_1} (2) = nN_A k_b \ln SP(A) \quad (86)$$

Equation (86) is Boltzmann's law for the mol-level (73a). It is obtained by setting the entropy equivalent to the change of heat in equation (85): if  $T = f = \text{cons.} = 1$  (*isotherm* = the certain event), then  $\Delta S = dQ_{rev} = K_{av}$ . We conclude again:

The **entropy** assesses energy exchange at the thermodynamic level.

Equation (86) also confirms that the temperature  $T_2/T_1 = V_2/V_1$  is a relationship of [3d-space]: when  $T_1 = 1 =$  the *certain event* or 1 *unit*, then  $T_2 = dV_2$ . This proportionality of temperature as thermodynamic time to volume (space) change is used in thermometers. Equation (1) in (86) is obtained for *adiabatic* conditions within mathematics:  $C_p$  is the heat capacity when  $P \approx E = \text{cons.}$  Equation (2) in (86) is obtained for an *isothermic* process ( $E \approx f = \text{cons.}$ ). Both states are abstractions - they illustrate that we can only measure time ( $T$ ) and space ( $V$ ) in a separate way by arresting one of them. However, space-time is a unity.

As we see, the mathematical presentations of the second law of entropy are adequate applications of the Universal Law - or more precisely, they are iterations of Boltzmann's law and the first law of thermodynamics within mathematical formalism. They depart from the assumption that  $Q$  is reversible  $Q_{rev}$ . In fact, it is not. This has triggered a collection of non-mathematical interpretations of the second law that have led to a fundamental paradox in thermodynamics. We call it the "**antinomy**" between the first and second law of thermodynamics. All paradoxes and antinomies in physics and science are introduced by inconsistent and illogical interpretations of correct mathematical results. This systemic failure of science could be eliminated for the first time by the discovery of the Universal Law and the development of the new axiomatics of science based on a single term. In order to underline this critical analysis, we shall present some typical interpretations of the second law of entropy that swirl like ghosts in the literature and embody the antinomy of the first and second law of thermodynamics:

"In a **reversible** process, the entropy change of the universe is zero ( $\Delta S = 0$ ). By "universe" we mean the system plus its surroundings."<sup>152</sup>

---

<sup>152</sup> PA Tipler, p. 579

“In an **irreversible** process, the entropy of the universe **increases**. For any process, the entropy of the universe never decreases. In an irreversible process, energy equal to the entropy change of the universe times the temperature of the coldest available reservoir becomes unavailable for doing work  $W_{lost} = \Delta ST = K_{av}$  (85)<sup>153</sup>.”

We summarize these two major statements of thermodynamics leading to a logical antinomy as follows:

- |   |  |
|---|--|
| 1. $S = E = cons.$ , or<br>$\Delta S = \Delta E = 0$  | This is the statement of the first law of conservation of energy as iterated by the second law for <b>reversible</b> processes.                      |
| 2. $\Delta S = \Delta E \geq 1$ , or<br>$S = E$ grows | This is the statement of the second law of entropy for <b>irreversible processes</b> . It is equivalent to the idea of an <i>expanding</i> universe. |

From this presentation, it is cogent that the antinomy between the first and second law stems from the inability of physics to define the primary term, although the definition of “world entropy“ is a hidden definition of space-time. None of the non-mathematical definitions of thermodynamics can explain entropy without introducing the primary term, for instance, as “surroundings“ or “universe“.

This antinomy is **eliminated** by the primary axiom of the new axiomatics: *universe = energy = space-time = cons.* The constancy of space-time is manifested by the parts, such as heat. The quantity “entropy“ is defined within mathematics as the action potential of the thermodynamic level that should be constant. This is the only possible method of definition and measurement of this quantity - hence its equivalence to Boltzmann’s constant ( $k_b$ ). All action potentials are constant according to the new axiomatics. This is also true for the entropy as a synonym for the action potential of the thermodynamic, kinetic level. This fact becomes evident when we look at the **probabilistic** presentation of entropy, which departs from Boltzmann’s law (equations (85) and (86)):

$$\Delta S = R/N_A \ln p = k_b \ln p = k_b 3T/2 = k_b SP(A) = E_A f \quad (87),$$

where  $p = SP(A)$ . This is the microscopic expression of Boltzmann’s law. When  $SP(A) = \ln p = 1$ , we obtain for the entropy:

$$\Delta S = k_b = E_{A(micro)} \quad (87a)$$

---

<sup>153</sup> PA Tipler, p. 579-580

**Entropy is the molecular action potential of the thermodynamic level** as defined by the theory of probabilities (method of definition = method of measurement).

This insight affects another great simplification in our outlook of nature. Departing from it, we shall subject the physicist's mind to a deep axiomatic (and not Freudian) analysis and elaborate how the notion of increasing entropy has occurred in his unreflected subconsciousness and established itself as a basic concept of physics<sup>154</sup>. For this purpose we depart from the not-so-famous **third law of thermodynamics**, known as the **Nernst's theorem of heat**. We shall use Planck's interpretation of this law. It says: "at the absolute zero point (*kelvin*), the entropy of completely ordered crystals is zero. If the entropy of any element is set zero at this state, then the entropy of any compound of elements will have a **positive** entropy." Recall that the absolute zero point of the Kelvin scale is obtained when the straight line in the plot of pressure versus temperature is extrapolated to zero pressure. Therefore the method of definition of the absolute zero point is mathematics. The extrapolation to zero pressure departs from the notion of homogeneous space-time, by attributing the number "0" to a hypothetical state of matter that can never be obtained in reality. The idea of homogeneous space-time is thus the ontological background of zero.

The key message of the third law is that we can arbitrarily ascribe the number "zero" to any of the quantities of the thermodynamic level, for instance, to  $T = 0$  and  $P = 0$ . This would mean that we practically eliminate the space-time of the thermodynamic level:  $E = K_{av} = 0$ . At this ideal zero-state of the thermodynamic level, there should be no thermal energy exchange with the photon level: if  $K_{av} = 0$ , then  $k_b = \Delta S = \text{entropy} = 0$ . Only under this abstract condition do we have a reversible thermodynamic process. However, this process has nothing to do with real space-time - it is a product of the degree of freedom of our mathematical consciousness. For this reason, the third law acknowledges willy-nilly that any real material system will have a thermodynamic level with an action potential that is, entropy, greater than zero. This artefact born in the realm of mathematics is defined in thermodynamics as "**growing entropy**":  $\Delta S = k_b \geq 0$ .

The notion of "growing entropy" is a **one-sided definition of the probability set**: it simply implies that all real events, being action potentials, have the theoretical probability that they will occur at some time - therefore their time or space is always greater than zero. As soon as the event has occurred, we

---

<sup>154</sup> There is a joke about *von Neumann* that is circulating in scientific circles. At the time when the concept of entropy was first introduced in physics, he used to recommend his students to write their doctor thesis on entropy, since nobody knew what it meant and for this reason they should not fear any critics. This joke illuminates the irrational ways of how new concepts and terms are introduced in science.

can compare it with itself and obtain the certain event:  $SP(A) = 1$ . When we apply this procedure to the primary term according to the principle of last equivalence:  $entropy=space-time=1=cons.$ , we automatically come to the conclusion that the term “entropy of the universe“ is equivalent to the primary term and is thus constant. Therein lies the entire humbug of “growing entropy of the universe“ - it is not a real physical phenomenon, but a symptom of distorted physicist’s mentality at the end of the Second Millennium.

*Exercise:*

1. Discuss **exponential growth** and **decay** of populations with respect to the new interpretation of entropy. Apply the same method to explain why the communist system decayed so rapidly. Discuss various cultural, social and economic tendencies of contemporanean life that will soon trigger a rapid decay of basic social organisations and structures of the „free“ market economy, such as pensions, healthcare, multinational corporations, EU, stock markets, money supply (e.g. inflation of M3), political parties, financial balance of states (e.g. sovereign debt) etc. Suggest remedies in the light of the Universal Law.

## 5.7 STANKOV’S LAW OF PHOTON THERMODYNAMICS (ND)

In chapter 5.6, we have shown that the entropy  $\Delta S$  is a synonym for the action potential of the microscopic thermodynamic level  $\Delta S = k_b$ , while  $\Delta S = Nk_b$  is the action potential of the macroscopic level, where  $N = nN_A$ . The definition of this quantity is also the method of its measurement. The change in entropy is measured by the macroscopic change in the kinetic (internal) energy of the object  $dK_{av}$ :

$$\Delta K_{av} = \frac{3}{2} Nk_b \frac{\Delta T}{dt} = \frac{3}{2} \Delta S f_T f_t = \Delta S \quad (88),$$

$$\text{when } f = 3/2 f_T f_t = SP(A) = 1,$$

where  $\Delta T = f_T$  and  $\Delta t = 1/f_t$ . Equation (88) summarizes the physical experience that when there is a *temperature difference*  $\Delta T$  at the level of matter, we always observe a heat exchange, called *thermal current*  $\Delta Q/t = \Delta K_{av}/\Delta t = I$  (76), which flows from the higher temperature to the lower temperature during the period  $\Delta t$ . The heat exchange is completed when the difference in temperature  $\Delta T = T_{max} - T_{equal}$  is equalized. The time  $T$  of the thermodynamic level tends towards a mean constant value,  $T_{mean} = f_{thermo} = cons.$ , because the space-time of this level is constant (see the interpretation of the zeroth law of thermodynamics in chapter 5.1). When we observe this energy exchange only at the material level, we never come across a process where there is an energy exchange from

a lower temperature to a higher temperature. This experience has led to the wrong idea of growing entropy in the universe. The origin of most wrong ideas in physics and in science lies in the human propensity to depart from a local experience and then generalize it. Whenever the epistemological arrow points from one part to other larger parts of the whole, the human mind is prone to arrive at wrong conclusions (vicious circle). Only when one departs from the whole, is it possible to comprehend the parts which contain the whole as an element. This is the basic operative principle of the new axiomatics.

The reduction of the temperature difference at the material level, which is conventionally interpreted as an increase in entropy, is, in fact, associated with an **equivalent reciprocal increase of the temperature difference at the photon level**. As this level has not been an object of study in thermodynamics - it is considered a vacuum -, this aspect has been overlooked. The reciprocal behaviour of the temperature (time) at the material and photon levels is a consequence of the *reciprocity of space and time*. This phenomenon can also be described with the reciprocal character of the LRC of contiguous levels (point 44.). For instance, we depart from this reciprocity to explain the regulation of the cell and organism in volume III. We can use the same approach to explain the reciprocal character of entropy.

Entropy is a synonym of the action potential of the thermodynamic level  $\Delta S = \Delta K_{av} = E_{A,thermo}$  (see equation (88)). According to the axiom of conservation of action potentials, this action potential is completely transformed into the action potential of the photon level during vertical energy exchange between these two levels:  $E_{A,thermo} = E_{A,photon}$ . The two action potentials behave reciprocally: when  $E_{A,thermo}$  disappears, as it is measured by  $\Delta T$  at the level of matter, an equivalent  $E_{A,photon}$  is simultaneously created at the photon level with the time  $\Delta T$ . Within mathematics, we have the degree of freedom to describe each action potential as an LRC and vice versa:  $E_A = LRC \approx \Delta T = f$ . According to the axiom on the LRC of two contiguous levels, the thermodynamic LRC of the material level will behave reciprocally to the thermodynamic LRC of the photon level: when  $LRC_{thermo,matter} \approx \Delta T = f \rightarrow 0$ , then  $LRC_{thermo,photon} \approx \Delta T = f \rightarrow max$ , or:

$$LRC_{thermo, matter} = - LRC_{thermo, photon} \quad (89),$$

respectively,

$$\frac{|LRC_{thermo,matter}|}{|LRC_{thermo,photon}|} = 1 = cons. \quad (89a)$$

The above equations are equivalent mathematical presentations of the constant character of space-time (primary axiom) and the reciprocity of space and time. In equation (89), this leads to the introduction of the *continuum of negative numbers* as a mirror image of the *continuum of real positive*

*numbers*. In equation (89a), we apply the principle of circular argument to build a ratio of the parts (thermodynamic and matter levels). All mathematical equations are applications of the principle of last equivalence for the parts. The *axiom of reducibility* (point 42) is another equivalent presentation of the axiom of conservation of action potentials, respectively, the axiom of the reciprocal LRC of contiguous levels. According to the axiom of reducibility, we can consider the thermodynamic level of the universe (space-time)  $E_{thermo}$  as a product of two entities, matter and photon space-time, that interact:

$$E_{thermo} = E_{thermo,matter} \times E_{thermo,photon} = 1, \text{ or } E_{thermo,matter} = 1/ E_{thermo,photon} \quad (89b)$$

This is a third equivalent presentation of thermodynamic space-time within mathematics. The three equations, (89), (89a) and (89b), demonstrate the intrinsic propensity of this hermeneutic discipline of the mind to express the primary term in different ways. Space-time is the origin of all mathematical operations.

This theoretical elaboration holds in any subset of space-time. It will be supported by the derivation of a novel application of the Universal Law for the **thermodynamic photon level**. For this purpose we take Planck's equation of photon energy  $E_p = hf$ , which is an application of the universal equation for this level, and solve it for the frequency of the maximal radiation as assessed by Wien's displacement law:  $f_{max} = c/\lambda_{max} = (c/B)T = K_{CBR}T$  (82). This law of radiation describes the vertical energy exchange between matter and photon space-time (see also chapter 5.5):

$$E_p = h f_{max} = hc/\lambda_{max} = h(c/B)T = hK_{CBR}T = E_A f \quad (90)$$

Equation (90) expresses photon energy as a function of temperature. It is an application of the universal equation for the *thermodynamic level of photon space-time*. The action potential of this level,  $E_{A,thermo} = hK_{CBR}$ , is a **new natural constant** because it is a product of two other constants. We call it **Stankov's constant**:

$$k_s = h(c/B) = hK_{CBR} = 6.85 \times 10^{-23} \quad (91)$$

When this constant is given in the SI system, it has the units  $[JK^{-1}]$ . In reality, it is a numerical relationship. We can now describe the energy of the thermodynamic level of photon space-time with the universal equation:

$$E_{p,thermo} = k_s T = E_A f \quad (92)$$

This is called **Stankov's law of photon thermodynamics**. It says:

When a thermal difference  $\Delta T$  is abolished at the material level during a period of  $\Delta t$ , and no work is done, the change of the

kinetic (internal) energy at the level of matter (equation (88)) is equivalent to the change at the thermodynamic level of photon space-time (axiom of conservation of action potentials):

$$\Delta K_{av} \approx \Delta E_p = k_s \Delta T / \Delta t = k_s f_T f_t = k_s f \quad (92a)$$

In terms of knowledge, we can explain this vertical energy exchange as follows. When  $T$  is maximal at the level of matter, photons with a maximal energy are emitted  $E_{p,max} \approx f_{Tmax} \approx T_{max}$  (see equation (90)). When the maximal temperature reaches the temperature of equivalence  $T_{mean}$ , the energy of the emitted photons becomes minimal:  $E_{p,min} \approx f_{Tmin} \approx T_{mean}$ . The maximal and minimal energy of the emitted photons build an **energy gradient** at the photon level  $\Delta E_p = LRC_p \approx \Delta T_{max}$  during the period of  $\Delta t$ . This energy gradient can be regarded as a distinct system of photon space-time with the time  $f = 1/\Delta t$ . It belongs to a new level of space-time, called the “**thermodynamic level of photon space-time**“. It goes without saying that this level is closely linked to the thermodynamic level of matter. In this way infinite levels of space-time can be defined. It is extremely important to keep in mind that such levels are U-subsets that contain themselves as an element and therefore can only be separated in the mind. This aspect of the primary term presents the greatest cognitive difficulties to the conventionally educated physicist.

The derivation of Stankov’s law eliminates the fundamental paradox of science as embodied in Boltzmann’s notion of *growing entropy* in anorganic matter (second law of thermodynamics) versus the evolution of organic matter, as first put forward by Darwin in a rudimentary form; organic evolution is thus viewed as a product of growing “**negentropy**“. The latter term was first introduced by Schrödinger in his brilliant book „What is life?“. It is reported that this paradox has triggered a mental distress to Boltzmann, so that he ultimately committed a suicide in 1906. In the light of the Universal Law, one may regret retrospectively that Boltzmann’s radical, self-consistent solution of a scientific paradox has not enjoyed a broader acceptance among other physicists. Much of the nonsense that has been subsequently generated in modern physics would have been spared.

While the notion of growing entropy is a one-sided perception of the vertical energy exchange from matter to photon space-time, evolution stands for the vertical energy exchange from photon space-time to matter as represented by photosynthesis of plants or direct, light-driven proton pumping in *halobacterium halobium*, which is considered one of the first, most primitive organisms of terrestrial evolution. Photosynthesis produces oxygen, which is a prerequisite for the development of animals and human beings, as they climb up the ladder of evolution. However, the photoreceptor of this prokaryote, called *bacteriorhodopsin*, that is responsible for proton pumping is conserved

as *rhodopsin* in rods and cones of human retina, where it is responsible for the conversion of photon energy into visual, spatial perceptions in the mind. Physics, being essentially geometry of space, is thus a recent metaphysical epiphenomenon of these spatial sensations, which have been made possible by the conservation of a “primitive“ transmembrane protein (see volume III).

This observation strongly questions the idea of biological evolution in its present form and suggests the existence of universal consciousness, which can be set equivalent to space-time from the restricted point of view of human consciousness. In reality, the universal consciousness is far more than the drei-dimensional space-time, which we can perceive - space-time, as described in this volume, is an U-subset of the universal consciousness. This is the departing point of developing new metaphysics of consciousness, which will reduce present-day physics of space-time, including the new physical and mathematical axiomatics, to a local case. It goes without saying that this new transcendental physics can only be developed by a new consciousness, which is infinitely more evolved than the restricted human mind at present. The good news is that human consciousness can evolve to the level of the universal consciousness<sup>155</sup>. We mention this issue in this chapter, because Stankov's law opens new perspectives for our physical knowledge that go far beyond the visible three-dimensional space-time, which we discuss in this volume. This law paves the theoretical background for the development of new sources of unlimited energy that exceed by far the most radical phantasies of present-day science fiction. These new technologies will dominate the way of life of the new enlightened society that will gradually emerge after the new theory of the Universal Law is fully implemented in science, education and social organisation.

---

<sup>155</sup> This evolution of mankind is known as “light body process“. At present, selected individuals are undergoing this process, so that their consciousness will soon evolve to the level of the universal consciousness. This mental evolution is associated with a profound energetic transformation of the human body. At the end of the light body process, these individuals will evolve to “multidimensional personalities“, that is, they will have a direct access to the original levels of cosmic energy, which we call „universal consciousness“, but may appear anytime as normal human beings in the three-dimensional space-time of the earth. As the universal consciousness creates the visible space-time, including organic life, these individuals will acquire immense knowledge on the actual structure of space-time. They will bring new technologies to mankind and will thus profoundly transform the life of human beings. I am preparing a book on this issue, titled “The Evolution Jump of Mankind at the Beginning of the Third Millennium in the Light of the New Theory of the Universal Law“.



## 6. ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM

### 6.1 ETYMOLOGY OF CONCEPTS

The etymology of the concepts, **electricity**, **magnetism** and **electromagnetism**, reveals that physics has developed an intuitively correct perception of space-time as an entity consisting of open U-subsets that can only be discriminated in the mind. All physical phenomena caused by the “*motion of charges*“ are subsumed under the term “electricity“. We shall prove that **charge** is a synonym of structural complexity  $K_s$  (chapter 6.2). This quantity is assessed as **area** by the conventional geometric method of definition and measurement of physical quantities:  $Q = K_s = SP(A)[2d\text{-space}] = \text{area}$ . The paradigm “ $K_s$  in motion“ is thus not only basic to most conventional laws (see chapter 3.6), it also determines the etymology of „electricity“. This term is a circumlocution of energy exchange at the *electric level*.

A main objective of this section will be to prove that charge is an abstract subset of space-time, that is, it is a space-quantity built within mathematics by arresting time  $f = 1$ . This quantity is then regarded in motion and defined as **electric current**. Due to the transitivity of mathematics, the concept “structural complexity (charge) in motion“ is an adequate perception of electric space-time leading to a mathematical derivation of a collection of conventional laws of electricity that are applications of the Universal Law.

In this context, the electric level is regarded as an **aggregated subset** of matter that includes the microscopic levels of particles (e.g. electrons, neutrons, protons, quarks etc.) and the macroscopic levels of matter (e.g. electric motors and devices). It is a well-known fact that all particles have a charge. We shall show that the basic photon also has a charge, that is, space. Being U-sets, the micro- and macroscopic levels of electricity cannot be separated. The voluntary decision to select the charge (area) of the electron as the **fundamental unit of charge  $e$**  is a pure convention of physics. This unit can be substituted by any other unit of area, e.g. 1 *meter* (see below). The charge (area) of all other levels and systems of electricity are conventionally expressed as the product of  $e$  by applying the universal equation to this quantity (principle of similarity):  $Q = ef$ , where  $f = \text{the continuum of integers}$ <sup>156</sup>. This

---

<sup>156</sup> „Two remarkable facts concerning charges have emerged from physics research up to the present. Using particle accelerators, complex nuclear reactions have been produced in which particles are created or destroyed...Every one of these particles has an electric charge that is an exact integer multiple of the electric charge: 0,  $\pm e$ ,  $\pm 2e$ ,... Quarks appear to have charges that are a fraction of the electronic charge. However, no particles having such fractional charges have ever been observed directly. Thus, it

preference for the integers over other numbers of the continuum goes back to *Millikan's oil-drop experiment*, with which the area of the electron was first measured<sup>157</sup>. The decision to use  $e$  as a basic unit of charge has led to the correct idea that energy is quantized. This intuitive idea of the inhomogeneity of space-time has been further developed in *Bohr's postulates* of quantum mechanics (see Bohr model in chapter 7.1).

The experience with electromagnetic forces has confirmed that, like gravitational forces, they interact **at a distance**. The assessment of such interactions must inevitably consider the vertical energy exchange between matter and photon space-time. Just as *Newton's law of gravity* appears to be a hidden definition of the vertical energy exchange between gravitational level of matter and the photon level (chapters 3.7 & 4.8), so do *Coulomb's law* and all other derivations of the Universal Law at the electric level. They introduce the space-time of the photon level as a **reference system**, with which the electric interactions between the material systems of the electric level are compared according to the principle of circular argument. This will become evident when we discuss the background of the two basic constants of electricity, the *permeability* and *permittivity of free space* (see chapter 6.3). As already stated on many occasions, all we can do in physics is to compare the space-time of one system with that of another. This will be proven in detail for all laws of electricity.

While the term “**electricity**“ is mainly reserved for the horizontal energy exchange between charged (electric) systems of matter, the term “**magnetism**“ is generally applied to the vertical energy exchange between the electric level of matter and photon space-time. However, this abstract distinction does not work in reality, as all levels of space-time are U-subsets and cannot be separated in real terms, but only in a metaphysical way in the mind. Willy-nilly, physics has considered this epistemological experience. It has accepted the fact that it cannot discriminate between electricity and magnetism. While the static view of electricity has prevailed at the beginning of this discipline - hence the term “**electrostatics**“ - this view has become more and more dynamic in the second half of the nineteenth century, and has led to the development of **electrodynamics**, which had to consider magnetism. Finally, the concept of **electromagnetism** has been introduced in physics. This etymological fact embodies the insight that space-time is an entity of open U-subsets.

---

currently seems that isolated charges cannot exist in units other than that found on the electron.“ Kane & Sternheim, *Physics*, p. 117 (see also chapter 6.2 and exercise 4. in this chapter).

<sup>157</sup> A detailed description of this experiment is given, for instance, in M. Carplus & R.N. Porter, *Atom and molecules*, W.A. Benjamin, 1970, p.14-17. The method of measurement of electric charge in this experiment is geometry so that the definition of  $e$  is  $K_s = \text{area}$ .

The static view of physics has produced two distinct laws of electricity, **Coulomb's law of static charges** and **Gauss's law of the electric flux**. Both are based on the concept of **electric fields**, just as Newton's law of gravity is based on the idea of gravitational fields. "Field" is a circumlocution of photon space-time when this level is epistemologically regarded as vacuum. This quantity is a consequence of the idea of void space. The concept of the field as an "action at a distance" is a systemic flaw in the present outlook of nature. This static view allows the abstract definition of the **magnetic field** as an entity that is distinct from the electric field. The magnetic field is basic to the definition of several laws of magnetism, such as **Biot-Savart law**, **Ampère's law** and **Gauss's law of magnetism**.

The impossibility of discriminating between the two phenomena, electricity and magnetism, first becomes evident in **Faraday's law**, which departs from the magnetic field and ends up with the electric field (**Stoke's integral theorem of Ampère's law**). These laws are mathematical variations of the Universal Law which have been developed historically. They document the gradual evolution of the physical outlook from the static towards a more dynamic point of view, as finally expressed by Maxwell. His achievement was the integration of all partial laws of electricity and magnetism into his famous **four equations of electromagnetism** by introducing the concept of the **displacement current**. We shall show that this quantity is a synonym for the **universal action potential of electromagnetism**. Maxwell's partial unification of physics in the field of electromagnetism can be regarded as the main precursor of our universal axiomatics of physics and mathematics based on a single term. For this reason, we often speak of **Maxwell's electromagnetism**, just as we speak of Newtonian mechanics.

Before we proceed with our discussion of electromagnetism, we should stress a simple fact: all the energy interactions that we encounter in daily life are of gravitational and electromagnetic origin. Especially the electromagnetic interactions are responsible for the shape and forms of material objects, beginning with the shape of mountains that will be normally flattened by gravitation and ending up with the crystal structure of substances. Nuclear and weak forces as defined in the standard model are of purely theoretical character - they are abstract U-subsets of space-time.

## 6.2 BASIC QUANTITIES AND UNITS OF ELECTRICITY (ND)

The units of the SI system can be reduced to seven, actually, six, fundamental *units* and their corresponding quantities (dimensions). At present, it is generally acknowledged that all other physical quantities constitute of these six dimensions. In the new axiomatics, we have proved that space-time has only two dimensions - the two constituents, **space** and **time**, which are dialectically linked and behave reciprocally. All other quantities can be derived from these two dimensions (see Table 2). This breakthrough has led to the unification of all physical disciplines to a self-consistent mathematical axiomatics. We have already shown that the three fundamental dimensions and their units - mass in *kg* (chapter 3.8 & 3.9), temperature in *grad* kelvin (chapter 5.1) and amount of substance in *mole/mol* (chapter 3.9) - are derived from space and time, or space-time.

We shall now prove that the remaining two quantities and their SI units - **charge  $Q$**  with the SI unit “**coulomb**“ ( $C$ ), and **current  $I$**  with the SI unit “**ampere**“ - can also be derived from the primary term. As the two quantities are defined in a circular manner, they can be reduced to one fundamental quantity and unit - hence the actual number of six basic SI units:

(1) „The SI unit of charge is the coulomb, which is defined in terms of the unit of electric current, the **ampere** (The ampere is defined in terms of a magnetic-force measurement...). The **coulomb** ( $C$ ) is the amount of charge flowing through a cross-sectional area ( $A$ ) of a wire in one second when the current in the wire is one ampere.“<sup>158</sup>

(2) „If  $\Delta Q$  is the charge that flows through the **cross-sectional area  $A$**  in time  $\Delta t$ , the **current** is  $\mathbf{I} = \Delta Q / \Delta t$ . The SI unit of current is the **ampere** ( $A$ ):  $1A = 1C/s$ .“<sup>159</sup>

As we see, this circular, tautological definition of the two fundamental quantities of electricity, charge and current, is based on the geometric method of measurement of their units. Actually, it is based on the definition and measurement of the (electro)magnetic force. The latter is a quantity assessing the space-time of the **electromagnetic level**  $E_{em} = F_{em} = SP(A)[1d\text{-space-time}]f$  when  $s = SP(A) = 1$  This force is also called **electromotive force (emf)**.

The classical definition of charge and current, as quoted above, implements mathematics inconsistently and introduces a systemic flaw in electricity that extends throughout the whole edifice of physics. This has not

<sup>158</sup> PA Tipler, p. 600.

<sup>159</sup> PA Tipler, p. 717

been realized so far. When the non-mathematical definition of electric current (2) is presented in mathematical symbols in physics, the quantity “cross-sectional area  $A$ ” is **omitted** without any reason:  $I = \Delta Q / \Delta t$ . This omission in the mathematical presentation of the current is a fundamental formalistic mistake with grievous cognitive consequences for this discipline. This becomes evident when we express the present formula of the current in non-mathematical terms: electric current  $I$  is the charge  $\Delta Q$  that flows during the time  $\Delta t$  or, alternatively: “current is charge per time.” This definition is meaningless, as physics “does not know what charge is”<sup>160</sup>. It is, indeed, incredible that the theory of electricity could have been established on such an evident blunder existing for more than two centuries without being noticed by anyone, considering the fact that this definition is a basic school stuff that is taught to billions of students worldwide. If physicists could feel ashamed, it is for this fundamental error that they have irrationally committed.

In reality, the current is measured in relation to the *cross-sectional area*  $A = [2d\text{-space}]$  of the conductor according to the principle of circular argument. When mathematical formalism is applied to physics in a consistent way, the correct presentation of the above definition of the **electric current** and its unit **ampere** should include the cross-sectional area, as this quantity is explicitly introduced as a reference system in the definition:

$$I = \frac{\Delta Q}{A \Delta t} = 1 \text{ ampere} = \frac{1 \text{ C}}{1 \text{ m}^2 \Delta t} \quad (93)$$

When we set the time  $f = 1/\Delta t = SP(A) = 1$  in equation (93), we obtain for the current unit  $1 \text{ ampere} = 1 \text{ coulomb}/1 \text{ m}^2$ . In order to comprehend equation (93), we must know what the unit  $1 \text{ ampere}$  really means. As with all physical definitions, the definition of this unit is at the same time the method of measurement of the corresponding quantity **electric current**:

„If two very long parallel wires one meter apart carry equal currents, the current in each is defined to be one ampere when the force per unit length on each wire is  $2 \times 10^{-7} \text{ N/m}$ .“

The current definition of the electric current and its SI unit ampere is an application of the axiom of reducibility for two arbitrarily selected, equal electric systems (wires) that interact with each other. All definitions of physical quantities and laws use subconsciously at least one of the three basic axioms of application, which we have axiomatically derived from the primary term: 1) the axiom of reducibility 2) the axiom of conservation of action potentials 3) the axiom on the reciprocal behaviour of the LRC of two contiguous levels. This insight is a leitmotif of the present volume.

---

<sup>160</sup> PA Tipler, German ed., p. 618

Back to the definition of electric current. The interaction between the two wires takes place at a distance of  $R = 1m$  and is mediated through the vertical energy exchange between these material systems and the photon space-time. The actual interaction is between the magnetic fields, which are built around the two equal electric segments:  $I_1\Delta l_1 = I_2\Delta l_2$ , where  $\Delta l_1 = \Delta l_2 = \Delta l = 1m$  and  $I_1 = I_2 = 1 \text{ ampere}$ . This interaction results in a new system of space-time that is measured by the motion of the two electric systems (recall that motion is the universal manifestation of space-time.). When the currents flow in the same direction, the wires are attracted; when the currents are antiparallel, the wires are repelled. This motion, which is a manifestation of the space-time of the resultant system, is assessed as an **electromotive force (emf)**<sup>161</sup>:

$$F = \frac{\Delta l}{R} \times \frac{\mu_o}{2\pi} \times I_1 I_2 = \frac{\mu_o}{2\pi} = 2 \times 10^{-7} [Nm^{-1}]. \quad (94),$$

where  $\Delta l/R = 1m/1m = SP(A)=1$  and  $I_1=I_2=1 \text{ ampere} = I_1 \times I_2 = SP(A)=1$ . As we see, the definition of the ampere also resorts to the number “1” as the universal symbol for presenting physical quantities. In reality, this is a hidden definition of the basic constant of electricity, the **permeability of free space  $\mu_o$** , which is a quantity of photon space-time (see chapter 6.3):

$$\mu_o = 2\pi F = 4\pi 10^{-7} [NA^{-2}] \quad (94a)$$

This result illustrates the ubiquitous fact that photon space-time can be adequately assessed through simple interactions between material systems. While classical mechanics deals with gravitational interactions, electromagnetism focuses on electromagnetic interactions. Both kinds of interactions are mediated by photon space-time, just as any material system exhibits simultaneously gravitational and electromagnetic properties that cannot be separated in real terms. The measurement of the electromagnetic force that is acting on the two segments is, in fact, a measurement of the space-time of the system resulting from this interaction:  $E = Fs = F$ , when  $s = 1m = SP(A) = 1$ . According to the axiom of reducibility, its energy is a product of the interaction of the two currents  $E = I_1 I_2$ . Departing from the principle of circular argument, we can assign this energy the primary number “1”, e.g. as 1 *joule* with respect to the SI system:

$$E = I_1 I_2 = 1 = 1 \text{ joule}$$

---

<sup>161</sup> This interaction was first discovered by *Oersted* who observed the effect of a current on a compass needle and was experimentally confirmed by *Ampère* for parallel and antiparallel currents.

We have deduced this equation axiomatically from our mathematical consciousness, just as any other physical law or equation (see also chapter 3.7). As any experiment is a tautology of the Universal Law, the method of measurement of the current unit ampere should confirm the above equation. Indeed, when we solve equation (94) for the energy:

$$E = I_1 I_2 = \frac{2\pi F}{\mu_o} = \frac{2\pi 2 \times 10^{-7}}{4\pi \times 10^{-7}} =$$

$$= SP(A)[1d - space - time]f[1d - space] = 1 \text{ joule} \quad (94b),$$

we obtain our axiomatically anticipated result. In the light of the new axiomatics, the actual definition of the current unit **1 ampere** should be as follows:

When the exchanged energy between two equal, arbitrarily defined electric currents (segments) placed at a distance of  $1m$  is  $1 \text{ joule}$  per *second* (introduction of the SI system), the space-time of each electric segment can be defined as the basic **electric action potential** with the current unit of **1 ampere**:

$$1 E_{A,electric} = 1 \text{ ampere} = 1[Js] = SPA[2d-space]f = SP(A) = 1 \quad (95)$$

In this case,  $[2d-space] = (\Delta l/R)^2 = (1m^2/1m^2) = SP(A) = 1$  and  $f = 1s^{-1} = SP(A) = 1$ . The current definition of ampere is an arbitrary decision with respect to the surrogate SI system and can be substituted by any other definition and system of reference. It is important to observe that this definition is **independent** of the wire material - it holds in any kind of conductor. The implications of this fact have been overlooked in electromagnetism. It reveals the *a priori* mathematical character of this definition, which can be confirmed by an experiment in a secondary manner.

Another important aspect of the conventional definition of the current unit is the assumption that the interaction occurs between two very long, actually, infinitely long, wires. This definition is based on the idea that the “parallel axiom“ of geometry is correct. However, this axiom could not be proven so far. We have shown that any motion of space-time is a rotation because space-time is a closed entity. This property of space-time is manifested by all systems - it is a fundamental “proof of existence“ that there are no straight paths or parallel wires in space-time. These are approximations of real paths of motion within Euclidean space of geometry. This becomes evident when we consider the fact that the two electric segments either attract or repel themselves. When this motion is considered, it is evident that the wires cannot remain parallel to each other in infinity. The notion of parallel straight lines in geometry is equivalent to the notion of closed systems in physics (N-sets) -

when the systems are open, they exchange energy and either expand (repulsion) or contract (attraction). This is a consequence of the reciprocity of space and time. Precisely for this reason, we have abolished the law of inertia. From these “proofs of existence“ we conclude that the parallel axiom is an erroneous concept of geometry and should be abolished as a mathematical device in physics.

If we now present the conventional definition of the electric current  $I = \Delta Q / \Delta t$  (2) in the new space-symbolism and solve it for the **charge Q**:

$$Q = I\Delta t = SP(A)[2d-space]f/f = SP(A)[2d-space] = K_s = area \quad (96),$$

we come to the conclusion that this quantity is a **pleonasm for geometric area,  $K_s$** . Equation (96) demonstrates the inner consistency and transitivity of the new axiomatics for any conventionally defined quantity of space-time. However, this formula is incomplete - as already said, it does not include the cross-sectional area  $A$ , without which the definition of current is meaningless. When we consider this quantity (93), we arrive at the following consistent definition of charge:

**Charge** is a two dimensional quantity of space  $SP(A)[2d-space]$ , which is obtained in relation to a well defined area according to the principle of circular argument, usually presented as a *cross-sectional area* of the conductor:

$$I\Delta t = \frac{\Delta Q}{A} = \frac{area_Q}{area_{reference}} = SP(A)[2d-space] = K_s \quad (96a)$$

When we compare two  $[2d-space]$ -quantities, we can either write  $SP(A)[2d-space]$  or  $SP(A)$  for the comparison. For instance, the area of a soccer field is a ratio to the arbitrary unit area of  $1m^2$ , which can either be expressed as a *number*  $SP(A) = n = 5000$  in mathematics or an *area*  $SP(A)[2d-space] = 5000 m^2$  in geometry. In equation (96a), the cross-sectional area is the reference magnitude that can be easily determined. The actual area of the “charges in motion“ ( $K_s$  in motion) is practically not known. It is obtained in relation to the cross-sectional area of the conductor, which we can precisely measure (principle of circular argument). Thus the measurement of the electric current, which is an action potential of the observed electric space-time, is, in reality, an indirect measurement of the **area of the particles in motion**. These can be electrons, protons, ions, or macroscopic assemblies of particles, such as solenoids of electric generators, motors, or transformers (see below). These devices can only operate when they are in circular motion. When there is no motion, that is, when no charge (area) flows, there is no current and no visible

energy interaction. This holds true for the electric current, as well as for the water current - both are distinct sources of energy.

Based on the conventional definition, we have proved that **charge is area**. We shall now present some fundamental derivations of the Universal Law that confirm this conclusion. These derivations are based on experimental results. As charge is area, we must automatically conclude that the SI unit **coulomb** is equivalent to the SI unit of square distance, *meter*<sup>2</sup>:

$$1 C = 1 m^2 \quad (97)$$

This is a basic statement of the new axiomatics. As it is a self-consistent categorical system that lacks any contradictions, it would be sufficient to reject this simple equation to refute the whole axiomatics and the existence of the Universal Law. However, this is not possible. Below, we shall prove that the equivalence between one coulomb and one square meter holds for the charge of the electron, which is defined as the **fundamental unit of charge**  $e$ , to which all other charges are compared  $Q/e = f$ . We begin with the evidence that the fundamental charge  $e$  is not the elementary area of space-time.

### **The Charge of the Basic Photon $q_p$ is the Elementary Area ( $K_s$ ) of Space-time**

The charge (area)  $q_p$  of the basic photon is the elementary area ( $K_s$ ) that builds the charge (area)  $e$  of the electron (inhomogeneity of the electric structure). This idea is basic to **Bohr model** of energy quantization of the hydrogen atom (chapter 7.1). In chapter 3.9 we have shown that the mass of the electron can be expressed as a discrete U-set of the mass of the basic photon  $m_e = m_p f_{c,e}$  (equation (45)). As mass is a space-time relationship, the same relation should also hold for the structural complexity (space) of these two systems, which are elementary action potentials of the electric and photon levels. The **charge (area) of the basic photon**  $q_p$  is a new fundamental constant that can be obtained from the charge of the electron  $e$  ( $f_{c,e} = c/\lambda_{c,e}$  is called **Compton frequency**):

$$q_p = \frac{e}{f_{c,e}} = 1.29669 \times 10^{-39} (C = m^2) \quad (98)$$

The charge of the basic photon can be regarded as the most **elementary area of space-time** which we can measure or calculate at present. We shall now perform a collection of derivations within mathematics that will anticipate some basic quantities and equations of electricity. We can imagine  $q_p$  as the cross-sectional area of the basic photon when the latter is defined as a trans-

versal electromagnetic wave that is propagated with the speed of light  $c$ . The square speed of light is defined as the *universal potential* of photon space-time:  $LRC = U_U = c^2$ . In electricity, the electric energy is defined as the product of charge and electric potential:  $E = QU = SP(A)[2d\text{-space-time}]$  (see chapter 6.7). This equation is an iteration of the universal equation. We can use this equation for the *basic photon* to obtain its **electric energy** and **structural complexity**  $K_s$ :

$$E = q_p U_U = q_p c^2 = q_p \lambda_A^2 = K_s =$$

$$SP(A)[2d\text{-space}] = 11.654 \times 10^{-23} m^2, \text{ as } f_p = 1 \quad (99)$$

In terms of electricity, photon space-time can be regarded as an **electric current** with the voltage of  $U_U = c^2 = 9 \times 10^{16} [V = m^2 s^{-2}]$  (see equivalence between SI units in chapter 6.7). In this sense, the structural complexity of the basic photon can be presented as an area integral of the basic photon when it is considered a standing wave with the wavelength of  $\lambda_A = 3 \times 10^8 m$ . This quantity is obtained within geometry and can be replaced by any other quantity of area. We use this quantity, because it is basic to the conventional geometric derivation of some important quantities of magnetism, such as **Bohr magneton**:

$$\begin{aligned} m_B &= \frac{e\hbar}{2m_e} = \frac{q_p \lambda_A^2}{4\pi} = \text{circle} - \text{area} = \\ &= \frac{\text{circumference}^2}{4\pi} = \frac{A^2}{4\pi} = 9.274 \times 10^{-24} m^2 \end{aligned} \quad (100)$$

In this case,  $q_p \lambda_A^2 = SP(A) \times (3 \times 10^8)^2 m^2 = K_s$  is *square circumference* and Bohr magneton is defined as the “area of a circle“. We shall show below that this circle is attributed to the electron. We must observe on this occasion that physicists are not aware of this geometric definition of Bohr magneton, which is a fundamental constant in electromagnetism and quantum mechanics. They believe that this quantity is an intrinsic property of matter, as is the case with any other physical quantity at present.

From Bohr magneton, the **atomic magnetic moments** are derived in magnetism of matter (chapter 6.12). Equation (100) confirms that any traditional quantity of material particles can only be defined in relation to the space-time of the photon level, in most cases to the space-time of the basic photon. Bohr magneton is a fundamental constant (area), from which the **magnetic moments** (areas) of the *elementary particles* are obtained within mathematical formalism and subsequently confirmed in experiments (see Table 1). Thus

equations (98) to (100) include the derivation of five basic constants of physics from the new constant, the **charge (area) of the basic photon**  $q_p$ , by employing the universal equation:

- 1) The fundamental unit of charge  $e$
- 2) Bohr magneton  $m_B$

The magnetic moments of:

- 3) Electron  $m_e$ ,
- 4) Proton  $m_p$ ,
- 5) Neutron  $m_n$ .

The formulae and values of these constants are summarized in Table 1. The new, simple derivations of the five constants are powerful evidence for the validity of the new axiomatics of the Universal Law and prove the unity of space-time. In the formula of Bohr magneton (100), the wavelength  $\lambda_A$  of the basic photon is intuitively assessed as a *circumference*. This seems logical when one recalls that each wave is a product of rotation. As all motions are rotations, any distance, which we define as a [*1d-space*]-quantity, is, in fact, a closed path that can be ideally expressed as the circumference of a circular motion. We have already met this approach in Kepler's third law. It is, indeed, very common in physics. Particularly in electromagnetism, it leads to the definition of *magnetic moments*. As any straight line is a section of a circumference when it is assigned to real space-time, we can describe any amplitude  $A$  (maximal expansion) of a wave as a circumference. The square circumference is thus an abstract quantity of [*2d-space*], called "**charge**". This is the degree of freedom of mathematical consciousness. This approach is the actual method of definition of the *fundamental unit of charge*  $e$ . Geometry is the hidden method of definition of this basic constant of electricity. We shall prove this fact below in detail.

### The Fundamental Unit of Charge $e$ is Geometric Area of the Electron

In equation (100) the structural complexity of the basic photon  $K_s = q_p \lambda_A^2$  is presented as **square circumference**  $A^2$ . This geometric quantity assesses the maximal extension of this system of space-time in terms of area. This is simple geometry applied to the real world. Although this fact has not been realized by physicists so far, the same mathematical approach has been used to assess the structural complexity of the electron.

In order to unveil this hidden definition, we must depart from **Pauli exclusion principle (Pauli-Verbot)**. It postulates that no two electrons of an atom can acquire the same quantum condition that is determined by the four *quan-*

*tum numbers*,  $n$ ,  $l$ ,  $m$  and  $m_s$  (see section 7.). These numbers are believed to describe the spatial configuration of electrons in the atom. In fact, Pauli principle is an interpretation of Schrödinger's wave equation of quantum mechanics as presented in **Fermi-Dirac statistics**. According to it, all **fermions**, e.g. electrons, protons and neutrons, have an **asymmetric function**  $\psi(x_2, x_1) = -\psi(x_1, x_2)$ , that is, they have a **half-integral spin** and obey the exclusion principle, while all **bosons**, e.g. photons, have a **symmetric function**<sup>162</sup>.

What is the vested knowledge behind such cryptic definitions, which are evidently of mathematical origin? We shall explain this for the basic photon and electron. The basic photon ( $h$ ) is regarded as a **transversal harmonic wave** that results from a circular motion. Although the actual sources of this circular motion are not an object of study in modern physics - this issue will be discussed for the first time in chapter 9.9 -, the basic photon is actually regarded as a **sphere** with the square circumference of  $K_s = q_p \lambda_A^2 = A^2$  (see equations (99) & (100) above). According to Pauli exclusion principle, the electron is considered a **standing asymmetric wave** that acquires the form of a **hemisphere** with the **surface area**  $S_e$  of

$$K_{s,e} = S_e = S_o/2 = \pi d^2/2 \quad (101),$$

where  $S_o$  is the area of the sphere, and  $d$  is the diameter. If we set the Compton wavelength of the electron  $\lambda_{c,e}$ , which is [ $1d$ -space]-quantity of this system, equal to the hypothetical diameter of the electron, we obtain for the **area** of the **electron hemisphere** a value that is almost equal to that of Bohr magneton (100):

$$S_e = 0.5S_o = 0.5\pi d^2 = 0.5\pi \lambda_{c,e}^2 = 9.247 \times 10^{-24} m^2 \cong m_B = 9.274 \times 10^{-24} m^2 \quad (102)$$

The small difference results from the fact that real systems are open and cannot have the form of real spheres, which are abstract closed systems. From the equivalence between the area of the electron hemisphere (102) and Bohr magneton  $S_e = m_B$  (100), we obtain the following equation (see also equation (98)):

$$\frac{q_p \lambda_A^2}{4\pi} = \frac{e}{f_{c,e}} \times \frac{\lambda_A^2}{4\pi} = \frac{\pi \lambda_{c,e}^2}{2} \quad (103)$$

When we solve this equation for the **fundamental unit of charge**  $e$ :

---

<sup>162</sup> It is important to observe that all basic concepts in quantum mechanics are of geometric origin, even when they are presented in terms of statistics. The reason for this is that the statistical magnitudes obtained from such tests are either space or time quantities. As time is reciprocal space, all mathematical evaluations in quantum mechanics end up in geometric presentations.

$$e = 2\pi^2 f_{c,e} \left[ \frac{\lambda_{c,e}}{\lambda_A} \right]^2 = SP(A)[2d - space] = K_s = 1.6 \times 10^{-19} m^2 \quad (104),$$

we obtain the **structural complexity  $K_s$  of the electron** in relation to  $K_s$  of the basic photon according to the principle of circular argument. We conclude:

The **fundamental unit of charge is area**  $e = 1.6 \times 10^{-19} m^2$ . The SI unit of charge **coulomb** is identical to the square SI unit of space, *meter*<sup>2</sup>:  $1 C = 1 m^2$ .

This explains for the first time why coulomb is considered a very big unit when applied to particles<sup>163</sup>. This new insight affects probably the greatest simplification of our physical outlook, not only from a theoretical point of view<sup>164</sup>, but also from a practical point of view, as many motors and machines used in daily life are electrically driven. At the same time, it reveals the most awkward mistake of physics - its decision to introduce the word “charge“ as a pleonasm for “geometric area“ without realizing the epistemological background of this fundamental quantity of electricity. Thus electricity and electromagnetism are **applied geometry** to the electromagnetic levels of space-time - they are simple studies of the electric form (structural complexity). This issue is a major topic in the present section.

*Exercises:*

1. Use the *doppler effect* to explain the attraction and repulsion of parallel and antiparallel current segments in the light of the Universal Law (see mechanism of gravitation in chapter 4.8).
2. Express the energy unit **electron volt**  $1eV = 1.6 \times 10^{-19} joule$  in the new space-time symbolism. Obtain the conversion factor of this unit to the SI unit of distance,  $1m$ . Discuss the method of definition of this unit from the unit  $1C=1m^2$ .
3. Use the reciprocity of time and space, respectively, of contiguous LRC, to explain why positively charged protons stick together in a nucleus with a

---

<sup>163</sup> Kane & Sternheim, Physics, Chapter 16.

<sup>164</sup> The knowledge that charge is area is very useful in explaining the charges of quarks, which are fractions of  $e$ . Within the new axiomatics, I have developed an elegant model which explains the fractional charges (areas) of quarks in a simple way. Until now this fact cannot be explained by QCD. Thus the new interpretation of the quantity “charge“ has a fundamental theoretical impact not only on electromagnetism, but also on QED and QCD.

radius of  $10^{-14}m$ , although they should repel according to the classical theory of electricity.

4. Use the geometric approach to explain in a simple way, why quarks have charges (areas) that are a fraction (1/3 and 2/3) of the electron area  $e = 1.6 \times 10^{-19} m^2$ . Derive the charges (areas) of quarks from the fundamental charge (area) of the basic photon. *Suggestion:* Depart from the geometry of the circle and the triangle.

### 6.3 WHAT ARE PERMITTIVITY AND PERMEABILITY OF FREE SPACE (ND)?

Before we discuss the *laws of electricity and magnetism*, we must first explain the epistemological background of the two fundamental constants, **permittivity of free space  $\epsilon_0$** , and **permeability of free space  $\mu_0$** , as they appear in the equations of these laws. The two constants are experimentally obtained, but physics is unable to explain their meaning. Conventionally, they are described as “material constants of vacuum“. The term “free space“ reveals that space (extent) is regarded “free of energy“, that is, vacuum (N-set). Unfortunately, electromagnetism gives no explanation as to how the void can exhibit constant material magnitudes that can be experimentally measured - the two constants,  $\epsilon_0$  and  $\mu_0$ , are parts of physical laws which are employed to measure electromagnetic interactions of matter. This observation discloses the profound confusion in this physical discipline. Therefore, the absurdity of defining the two constants as “quantities of *free* space“ should be cogent to everybody.

We shall now prove that the two constants are **quantities of photon space-time**, which are used as a reference frame in electromagnetism to measure the space-time of the material electric systems according to the principle of circular argument. For this purpose, we depart from the famous **Maxwell’s equation of electromagnetism** that associates these constants with the *speed of light  $c$* :

$$c = 1/\sqrt{\mu_0 \epsilon_0}$$

The speed of light is a one-dimensional quantity of the space-time of the photon level. When this quantity is expressed as LRC, we obtain:

$$c^2 = LRC = U_U = \frac{1}{\mu_0 \epsilon_0} = [2d - space - time]_p \quad (105)$$

or

$$c^2 \mu_0 \epsilon_0 = \frac{c^2}{[2d - \text{space} - \text{time}]_p} = 1 = \text{certain event} \quad (105a)$$

Maxwell's equation is basic to his four equations of electromagnetism. It is an application of the universal equation for the photon level: when photon space-time is compared with itself, we obtain the certain event  $SP(A) = 1$ . This equation stems from the mind and can be experimentally confirmed in a secondary manner - hence its universal validity in electromagnetism and physics. Einstein's famous equation of energy  $E = mc^2$  is thus a mathematical pleonasm of Maxwell's equation, and I hope the reader can appreciate the heavenly irony behind the great illusion of this "great man" of physics.

The dimensionality of the two constants can be easily obtained when we consider their method of definition and measurement. For this purpose, we take the basic law of electricity, *Coulomb's law*; the other laws of electromagnetism are mathematical derivations from this law. At present, these iterative products of mathematics in electromagnetism are believed to be distinct laws, notwithstanding the fact that they converge in Maxwell's four equations, with which all electromagnetic interactions are completely described (see chapter 6.13).

In Coulomb's law, the **Coulomb constant**  $k$  is given in relation to the *permittivity of free space*  $\epsilon_0$ :  $k = 1/4\pi\epsilon_0 = SP(A)\epsilon_0$ , according to the principle of circular argument. The method of definition is geometry (see equation (36)). This means that  $\epsilon_0$  has the same dimensionality as Coulomb constant, while this constant is defined in the same way as the universal gravitational constant  $G = [1d\text{-space-time}]f$  (see equation (35)). This follows from the identical method used to express Newton's law of gravity and Coulomb's law of electricity - the axiom of reducibility. Both are applications of the Universal Law and can be ontologically derived from our mathematical consciousness (see chapter 3.7). Another reason for this equivalent mathematical expression of the two laws is that the basic quantities of these laws, charge and mass, are defined in a static way:  $m, q \Rightarrow K_s = SP(A)[2d\text{-space}] = SP(A)$ , when  $f = 1$  and  $[2d\text{-space}] = 1$ :

$$\begin{aligned} F &= G \frac{m_1 m_2}{r^2} \Leftrightarrow k \frac{q_1 q_2}{r^2} = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} = \\ &= \frac{1}{4\pi\epsilon_0} \frac{SP(A)[2d - \text{space}]}{[2d - \text{space}]} = \frac{1}{4\pi\epsilon_0} SP(A) \end{aligned} \quad (106),$$

where  $q_1 q_2 = q$  (axiom of reducibility)<sup>165</sup>. When we solve this equation for the *reciprocal value* of the **permittivity of free space**  $1/\epsilon_0$ , we obtain the actual dimensionality of this constant:

$$\frac{1}{\epsilon_0} = \frac{4\pi F}{SP(A)} = \frac{SP(A)[1d - space - time]f}{SP(A)} = [1d - space - time]f = a \quad (106a)$$

as  $4\pi SP(A) = SP(A)$ : The **quantity**  $1/\epsilon_0$  is **acceleration** (3). This quantity of space-time is usually given as a specific constant of each system, for instance, as  $g$  for the gravitation of the earth or  $G$  for the gravitational constant of the visible universe. In electricity, this quantity is introduced analogously to the gravitational acceleration  $g = F/m = F/SP(A)$  in classical mechanics:

„The electric force exerted by one charge on another is an example of an action-at-a-distance force that is similar to the gravitational force exerted by one mass on another. To avoid the problem of action at a distance, we introduce the concept of electric field  $E$ . One charge produces an electric field  $E$  everywhere, and this field exerts the force on the other charge...The electric field  $E$  at a point is defined as the net force on a positive test charge  $q_0$  divided by  $q_0$ :

$$E_0 = \frac{F}{q_0} = \frac{SP(A)[1d - space - time]f}{SP(A)} = [1d - space - time]f = a = \frac{1}{\epsilon_0} \quad (107)$$

The definition of the **electric field**  $E_0$  is circular; it departs from Coulomb's law of the electric force (see chapter 6.4) and repeats the same epistemological mistake performed in classical mechanics. It introduces the new quantity "electric field" as a pleonasm for the quantity "acceleration" which is reciprocal permittivity of free space  $1/\epsilon_0$ :  $E_0 = 1/\epsilon_0$ . This quantity assesses photon space-time. This is also evident from Maxwell's equation of the speed of light:  $c = 1/\sqrt{\mu_0 \epsilon_0}$ .

In the new axiomatics, we call the mean acceleration of the gravitational photon level, which is a U-subset of photon space-time, "**universal gravitational constant**"  $G = g_U$  (equation (35)). At present, the two constants,  $E_0$  and  $G$ , are believed to be distinct quantities. This hinders the integration of gravitation with electromagnetism. In fact, the two constants,  $E_0 = 1/\epsilon_0 = \mu_0 c^2$  (105) and  $G = c^3/E_{AU}$  (29), or  $G = c^2/S_U$  (37), are abstract U-subsets of photon space-time defined within mathematics - they are interrelated through  $c$ , which is a

<sup>165</sup> The axiom of reducibility acquires a simple form in geometry: for instance, the product of two areas is also area:  $1m^2 \times 10m^2 = 10m^2$ .

[1d-space-time]-quantity of the photon level. We have proved this by deriving Newton's law of gravity from the universal equation (28). This example brings into a focus the cognitive mess of modern physics. From this elaboration we conclude:

The **electromagnetic photon level** and the **gravitational photon level** are defined in conventional physics as **geometric U-subsets** of the **photon level**.

The latter can be regarded as the aggregated set of these levels, as well as of all those levels to which we have no access at present. This is also true for the magnetic level as part of the electromagnetic photon level (see below). The difference between these levels of photon space-time is not of real character, but is introduced through their method of definition, which is geometry. It is also the method of measurement of their basic constants,  $G$  and  $E_o$ . This is a clear-cut explanation of the etymological origin of electromagnetism and gravitation.

The mathematical (geometric) background of the electric quantities of electromagnetism becomes evident when we analyse how **Coulomb constant** is obtained from the *permittivity of free space* (see also equation (36)):

$$\begin{aligned} k &= \frac{1}{4\pi\epsilon_o} = \frac{E_o}{4\pi} = \frac{\text{acceleration}}{4\pi} = \\ &= \text{circle-area} = \frac{\text{circumference}^2}{4\pi} = A = \frac{u^2}{4\pi} \end{aligned} \quad (108)$$

In the new axiomatics, we define the **reciprocal permittivity of free space**:

$$1/\epsilon_o = E_o = [1d\text{-space-time}]f = 0.11294 \times 10^{12} \text{ ms}^{-2} \quad (109)$$

as the **universal quantity** of the electric photon level, which is conventionally used as a *reference frame* in electromagnetism. We also call this quantity the „**electric field**“ or „**electric acceleration**“ of photon space-time.

In our subsequent derivations, we shall use the quantity  $E_o$  instead of the permittivity of free space for the purpose of cognitive clarity. The magnitude of this quantity is very important for an understanding of the new theory of cosmology (see section 9.).

When we set the dimensionality of the electric field of photon space-time in Maxwell's equation of the speed of light, we obtain for the reciprocal value of the **permeability of free space**  $1/\mu_o$  the dimensionality of a *distance* ([1d-space]):

$$\frac{1}{\mu_o} = l_{\mu_o} = \frac{c^2}{E_o} = \frac{[2d - space - time]}{[1d - space - time]f} = [1d - space] = 0.795775 \times 10^6 m$$

(110)

We call this new fundamental constant of electromagnetism the **magnetic field length**  $l_{\mu_o}$  of photon space-time.

This new constant is of great importance to the new theory of cosmology based on the Universal Law. The *magnetic field length* gives us information on the **mean space** of important gravitational systems, such as *neutron stars*, *white dwarfs*, *quasars* and *black holes* (chapter 9.9). These celestial objects act as *powerful generators* that determine significantly the electromagnetic properties of photon space-time, that is, the rotational parameters of this fundamental level. This is an ultimate proof that space-time is a closed entity of open U-subsets, or more precisely, of superimposed rotations, that contain themselves as an element and evolve in a perfect (pre-stabilized) harmony. Here, we shall only draw the reader's attention to the fact that any of the aforementioned gravitational objects can be completely described in terms of "mass, angular momentum (24) and electric charge"<sup>166</sup>, which are abstract quantities of the space-time of these rotating systems within mathematical formalism (see chapter 3.4). This also holds for the elementary particles - quantum mechanics can only present them as rotational systems (see section 7.).

---

<sup>166</sup> R & H Sexl, *Weißer Zwerge - Schwarze Löcher* (White Dwarfs - Black Holes), vieweg, Braunschweig, 1979, p. 81.

## 6.4 COULOMB'S LAW AND THE ELECTRIC FIELD

**Coulomb's law** assesses the interaction between two static charges within geometry by applying the axiom of reducibility, as the following standard definition illustrates:

„The force exerted by one point charge on another acts along the line joining the charges. It varies inversely as the square of the distance separating the charges and is proportional to the product of the charges... Coulomb's law can be stated more simply using a *mathematical* expression. Let  $q_1$  and  $q_2$  be two point charges that are separated by a distance  $r_{12}$ , which is the magnitude of the vector  $\mathbf{r}_{12}$  pointing from charge  $q_1$  to  $q_2$ . The force  $F_{12}$  exerted by charge  $q_1$  on  $q_2$  is then:<sup>167</sup>

$$F_{12} = k \frac{q_1 q_2}{r_{12}^2} \mathbf{r}_{12} = \frac{E_o q_1 q_2}{4\pi r_{12}^2} = \frac{E_o q_1 q_2}{\text{spherical - area}} = SP(A) [1d - space - time] f$$

(111),

where  $\mathbf{r}_{12} = \mathbf{r}_{12}/r_{12} = SP(A) = n$  is defined as a unit vector pointing from  $q_1$  to  $q_2$ :  $q_1 q_2 = q = SP(A) [2d\text{-space}]$  (axiom of reducibility). The geometric approach is cogent. The photon system enclosed by the two charges is regarded as a sphere with the area of  $A = 4\pi r^2$ . This  $[2d\text{-space}]$ -quantity can be measured. The energy interaction between the two charges can be either attraction (opposite signs of the charges) or repulsion (charges have the same charge). The positive and negative signs attributed to charges represent a mathematical convention that gives the conditions of constructive or destructive interference of waves. Both phenomena are a manifestation of the reciprocity of space and time. The motion of material charges is mediated through the photon system that is confined by the two charges, just as gravitation is mediated by the photon system that is confined by two material objects (see chapter 4.8). The two charged material systems (recall that all systems of matter have a charge and vice versa: there is no charge without matter) enter into a vertical energy exchange with the photon system to exert a horizontal energy exchange as assessed by **Coulomb force** (equation (111)).

Coulomb's law involves the space-time of the photon system as a reference frame. This becomes evident when we solve equation (111) for the electric field. If we regard  $q_2$  as a test charge  $q_o$ , that is, if we set  $q_o=1$ , we obtain from

---

<sup>167</sup> PA Tipler, p. 603-604

Coulomb force the electric field of the charge  $q_1$ :  $E_1 = F_{12}/q_2$  or  $F_{12} = E_1 q_2$ . If we now substitute the force in *Coulomb's law* with this term and rearrange it, we obtain the universal equation as a rule of three:

$$\frac{E_1}{E_o} = \frac{q_1}{A} = \frac{SP(A)[2d - space]_1}{SP(A)[2d - space]_R} = SP(A) = K_{1,R} \quad (111a),$$

where  $A = 4\pi r_{12}^2$  is the **reference area**. We are again confronted with the simple truth that all we can do in physics is to compare the space-time of one system or a quantity thereof with that of another system. The new derivation of Coulomb's law confirms that this basic law of electricity is a simple comparison of space magnitudes within geometry (method of measurement) because the quantities used in this application of the Universal Law (electric field and charge) are geometrically defined (method of definition).

Equation (111a) illuminates the cognitive mess in electricity. The charge  $q_1$  is regarded as a point, that is, it should have no volume or surface. As charge is area, the  $q_1$  of a charge point should be zero  $q_1 = 0$ . In this case, the ratio  $q_1/A$  should also be zero  $0/A = 0$ . However, this equation is meaningless - in practice, Coulomb law would always render zero values for any charge interaction, if we assume that charges are spaceless points. This is a typical example of the theoretical problems which always emerge when mathematics is applied to the physical world without comprehending its basic properties. In reality,  $q_1$  has a definite magnitude for each charged system, which can become increasingly small, depending on the space-time of the system. On the other hand, the spherical area of the photon space-time ( $A = K_s$ ), which surrounds an electric system, may increase when the distance between the two interacting charges increases. However, the ratio of the two magnitudes always has a finite value  $q_1/A = SP(A) = K_{1,R}$  for any pair of static charges that interact at a distance.

Like any other application of the Universal Law, Coulomb's law assesses the interaction between the charges according to the axiom of reducibility  $F_{12} = E_1 q_2$ , by setting the electric field (acceleration)  $E_1$  for the first entity  $q_1$  and the charge  $q_2$  for the second entity. This presentation is borrowed from classical mechanics, where the earth's space-time is given as gravitational acceleration  $g$  and the space-time of the object as mass  $m = K_s = SP(A)[2d - space] = SP(A)$ . This presentation results in Newton's second law  $F = mg$ . The space-time of the resultant system, given by the force  $F$ , is compared to the space-time of the photon level, given by the universal gravitational constant  $G = g_U$ , which is also acceleration (see equation (29)). This mathematical equation established by the axiom of reducibility produces Newton's law of gravity (equation (27)). Like Coulomb's law, this law is a comparison between the space-time of the resultant gravitational system and the space-time

of the photon level in terms of acceleration, usually the earth's acceleration  $g$  ( $M$  is the earth's mass):

$$g = G \frac{M}{r^2} = g_U \frac{SP(A)[2d - space]}{[2d - space]} = g_U SP(A)$$

or

$$\frac{g}{g_U} = SP(A) = K_{M,U} \quad (112)$$

We conclude:

**Coulomb's law of electricity** (equations (111) & (111a)) and **Newton's law of gravitation** (equation (112)) are applications of the Universal law as a rule of three. Both laws use **photon space-time** as a reference frame, to which any gravitational or electric system is compared within mathematics according to the principle of circular argument. Hence the equivalent mathematical expression of the two laws.

The similarity between the two laws has been superficially acknowledged in conventional physics, however, without explaining its cognitive background: "Note the similarity between Coulomb's law and Newton's law of gravity. Both are inverse-square laws."<sup>168</sup> For this reason, Newton's law of gravity is also called **inverse-square law of gravity**.

It has been established that many natural laws are **inverse-square laws**. There is nothing mystical about this mathematical presentation - it is not a property of matter, as is generally believed, but a simple geometric formalism introduced by man in physics. The inverse-square distance is actually the **area** that is obtained within mathematics when the space-time of any two interacting entities, which are regarded as mass points or charge points ( $K_s = 0$ ), is statically described as space-vectors,  $[1d-space]_1$  and  $[1d-space]_2$ , in Euclidean three-dimensional space. By applying the axiom of redicibility, the space-time of the resultant system is then expressed as an area:

$$\begin{aligned} E &= 1/[1d-space]_1 \times 1/[1d-space]_2 = 1/[2d-space] = \\ &= 1/r^2 \Rightarrow \text{inverse-square laws} \end{aligned} \quad (113)$$

---

<sup>168</sup> PA Tipler, p. 604

The inverse-square laws are applications of the Universal Law - they assess the reciprocity of energy and space, respectively, of time and space:  $E \approx f = 1/[2d\text{-space}]$ .

Coulomb's law is a static assessment of the electric space-time in terms of space (charge or area). Many terms and quantities that play a major role, not only in physics, but also in chemistry and related disciplines, such as biochemistry, pharmacology and other bio-sciences (see volume III), are introduced through this law. For instance, a system of two equal and opposite charges  $q$  separated by a small distance  $L$  is called an **electric dipole**. This system can be a molecule or a macroscopic material system:

$$p = qL = SP(A)[2d\text{-space}] \quad (114)$$

Equation (114) illuminates a major cognitive problem of geometry that has already been known to *Descartes*<sup>169</sup>, but has been profoundly misapprehended by most scientists after him. When a  $[2d\text{-space}]$ -quantity is multiplied by a  $[1d\text{-space}]$ -quantity, we obtain a  $[2d\text{-space}]$ -quantity, unless it is specified that they are perpendicular. In this case, we obtain a  $[3d\text{-space}]$ -quantity. For instance, a path that is  $1m$  large and  $1m$  long will have an area of  $1m^2$ . Now, if we need this path to be  $10m$  long, we have to pave the area of  $1m^2 \times 10m = 10m^2$  and not of  $10m^3$ , while a cube with the basis of  $1m^2$  and the height of  $1m$  will have a volume of  $1m^3$ . Although this mathematical procedure is cogent, it does not seem so obvious in modern geometry and topology, especially when these disciplines are applied to physics. In modern physics, it is a common practice to introduce numerous  $n$ -dimensional spaces, which unnecessarily complicate the presentation of physical phenomena and obscure the simple epistemological fact that human mind can only perceive space as one- two or three-dimensional extent. Any spatial dimensions that go beyond 3d-space are mathematical artefacts introduced in the physical world. In fact, geometric dimensions are mathematical quantities that do not exist in reality, but are products of an abstract definition. The definition of perpendicularity is such a definition. The simple truth is that any  $[nd\text{-space}]$ -expression of space-time is equivalent to  $[1d\text{-space}]$ -expression when the principle of last equivalence is applied (21-2). This axiomatic knowledge is illustrated by the formula of the electric dipole:

$$p = qL = SP(A)[2d\text{-space}] = SP(A)[1d\text{-space}],$$

$$\text{when } q = SP(A) \text{ and } L = [1d\text{-space}]$$

---

<sup>169</sup> R. Descartes, *Philosophische Schriften*, Felix Meiner Verlag, Hamburg, 1996, Regel 18, *Geometrische Algebra*, p. 157-165.

This knowledge is also important for an understanding of the concept of **electric-field lines**, which is basic to the derivation of *Gauss's law* (chapter 6.5). In order to demonstrate the cognitive blindness of traditional physics with respects to its method of definition of basic terms and quantities, we shall quote a collection of traditional statements of electricity regarding the concept of electric-field lines:

„It is conveniently to *picture* the electric field by *drawing lines* to indicate the direction of the field at any *point*... There is a connection between the *spacing of the lines* and the strength of the electric field. Consider a *spherical surface* of radius  $r$  with its *center* at the charge. We are interested in the *number of lines per unit area of the sphere*, which we will call the *density of the lines*... The *area of the sphere* is given by  $A = 4\pi r^2$ . The *numbers of lines per unit area of the sphere* thus decreases inversely with the square of the distance from the point charge. But the strength of the electric field,  $E = kq/r^2$  also decreases inversely with the square of this distance.“<sup>170</sup>

Exercises:

1. Show that the above method of geometric definition of the concept “*electric-field lines*“ is identical to the **aesthetic** and **theoretical concepts** of most *avantgarde movements* in arts at the turn of the twentieth century, such as *French pointillism* (coloured points for expressing various forms, mass and density of objects) , *Braque's* and *Picasso's cubism* (cube, conus, cylinder and sphere as the four basic forms (U-sets) of the visual world), *Russian suprematism* and *structuralism* and *Italian futurism* (lines, vectors and other geometric structures used to depict modern industrial life)<sup>171</sup>.
2. Explain why the **law of conservation of charge** is an iteration of the law of conservation of energy as expressed by the axiom of conservation of action potentials.
3. Prove that the formula of the *acceleration* of the electric charge  $a$  in the electric field  $a = q/m \times E$  is a vicious definition of the same quantity by employing the concept of closed systems ( $g = 0$ ).
4. Discuss the terms, *conductors*, *insulators* and *charging by induction*, in the light of the new axiomatics (see also chapters 6.8, 6.10 and 6.11).
5. Prove that the so called “**growth laws**“ or “**power laws**“, are *logarithmic* expressions of the Universal Law (universal equation) presented as *inverse-*

<sup>170</sup> PA Tipler, p. 612.

<sup>171</sup> For further reading see: P. Signac, D'Eugène Delacroix au néo-impressionnisme, 1895; A. Gleizes & J. Metzinger, Du „cubisme“ 1912; Kandinski, Über das Geistige in der Kunst, 1910; Marinetti et il futurismo, ed. L. de Maria, 1973 etc.

*square law* and are thus iterations of Coulomb's law of electricity and Newton's law of gravity. Discuss the role of these laws in the definition of basic concepts of Chaos theory, such as *fractal dimension* (Hausdorff's dimension), *Koch snowflake curve*, *Mandelbrot's lacunarity*, *principle of self-similarity* at different scales etc. Use the universal equation as growth law for organic matter to explain the biological regulation at the molecular, cellular and organic level (see volume III).

## 6.5 GAUSS'S LAW AND ITS APPLICATIONS

In chapter 6.4, we have learned that the electric field is electric acceleration and that Coulomb's law assesses charge interactions by comparing the area of the charged systems. Although this law is solved for the force, it can also be expressed for the electric field. Due to the transitivity of mathematics, one can depart from Coulomb's law to obtain the electric field. This is a common exercise in electricity. It acknowledges the basic cognitive fact of the new axiomatics, namely, that energy is discrete (quantized) and continuous, however, without pushing this aspect further to its consequent end: "On a microscopic scale, electric charge is *quantized*. However, there are often situations in which many charges are so closed together that the total charge can be considered to be *continuously* distributed in space."<sup>172</sup> The continuous distribution of charges (area) is then quantitatively evaluated. This leads to the introduction of a collection of quantities, which are iterations of well known quantities in mechanics, as well as to the derivation of **Gauss's law**.

Just as we set mass in relation to volume to obtain the mass density (equation (47)), we can set the charge (area) of electric systems in relation to the volume of the corresponding photon system and obtain the **volume charge density**:

$$\rho = \frac{\Delta Q}{\Delta V} = \frac{SP(A)[2d - space]}{[3d - space]} = \frac{SP(A)}{[1d - space]} \quad (115),$$

the **surface charge density**:

$$\sigma = \frac{\Delta Q}{\Delta A} = \frac{SP(A)[2d - space]}{[2d - space]} = SP(A) \quad (116),$$

or the **linear charge density** (see also the quantity mass per unit length  $\mu$  in (54)):

---

<sup>172</sup> PA Tipler, p. 624

$$\lambda = \frac{\Delta Q}{\Delta L} = \frac{SP(A)}{[1d - space]} \quad (117)$$

This is applied geometry that forms the basis of **classical electrostatics**. These quantities appear again in electromagnetism, however, expressed in a different mathematical form (see chapter 6.13). The **electric field** is conventionally obtained from Coulomb's law in the following manner:

$$E = \int_V \frac{k dq}{r^2} \hat{r} = [1d - space - time] f \quad (118)$$

This equation confirms the transitiveness of the new axiomatics, which is based on mathematics. This is also true for the following geometric derivations of the electric field in electrostatics: a) E on the axis of a *finite* line charge; 2) E on the perpendicular bisector of a *finite* line charge; 3) E near an *infinite* line charge; 4) E on the axis of a ring charge; 5) E on the axis of a uniformly charged disk 5) E near an *infinite* plane of charge etc. We leave the elaboration of these cases within the new axiomatics to the reader and only point at the fact that these presentations result from the intuitive perception of the infinity of space-time and the finite magnitudes of its systems.

The extensive use of geometry in electricity has led to a novel derivation of Coulomb's law, called **Gauss's Law**, by introducing the new quantity **electric flux**  $\phi$ . This application of the universal equation allows the qualitative description of the electric field on a closed surface related to the net charge (area) within the surface by using the concept of electric-field lines. For this purpose, the **electric flux** is defined as the product of the field E and the area A that is cross-sectional (perpendicular) to its electric-field lines:

$$\phi = EA = [1d-space-time] f \times [2d-space] = [2d-space-time][1d-space] \quad (119)$$

Usually, this equation is given in the integral form for the **net flux** through a closed surface:

$$\phi_{net} = \oint_S E_n dA = SP(A)[2d-space-time][1d-space] = Es = E_a v \quad (119a),$$

where SP(A) stands for integration. Equation (119a) is a variation of the universal equation  $E = E_A v / s = E_A f$  as presented in point 25, equation (25-1). There are various derivations of Gauss's law which illustrate the common origin of this law from Coulomb's law, that is, from the universal equation. A common geometric formula is the one that assesses the net flux through any surface with respect to the *net charge* (area) *inside*  $Q_{inside}$ :

$$\phi_{net} = \oint_S E_n dA = 4\pi k Q_{inside} = \frac{1}{\epsilon_0} Q_{inside} = E_o Q_{inside} = Es = E_A v \quad (119b)$$

Gauss's law is used for the quantitative evaluation of the electric charge (area) within a closed photon system in relation to the arbitrarily defined surface of this system, which is usually considered to be a closed area. Thus Gauss's law is not a distinct law, but a geometric variation of Coulomb's law.

*Exercises:*

1. Express the following geometric applications of Gauss's law in the new space-time symbolism and discuss them from a methodological and cognitive point of view: a) E near a point charge; b) E near an infinite plane of charge; c) E near an infinite line charge; d) E inside and outside a cylindrical shell of charge e) E inside and outside an infinitely long cylinder of a charge f) E inside and outside a spherical shell of charge; g) E inside and outside a uniformly charged solid sphere etc.
2. Discuss the concept of discontinuity of the electric field in electrostatics  $E_{n2} - E_{n1} = \sigma/\epsilon_0$ . Show that this concept considers electric space-time as discrete, but continuous, that is, the term "discontinuity" is a synonym of discreteness (ambiguity of language).
3. Explain *electrostatic equilibrium* with the reciprocal behaviour of the LRC of contiguous levels. *Suggestion:* depart from the formulae:  $E_n = \sigma/\epsilon_0 = \sigma E_o = SP(A)[1d\text{-space-time}] f = F$  or  $\phi_{net} = qE_o$  (119b).

## 6.6 NABLA- AND LAPLACE-OPERATORS

To understand electromagnetism, we must introduce an important application of *differential calculus* in physics and discuss it in the light of the Universal Law. Differential calculus was invented by Newton and Leibniz to assess *instantaneous velocity* from its constituents, space and time. The differential method is also used for the derivation of the *classical wave function* (see chapter 4.5), which is basic to *Maxwell's equations of electromagnetism* (chapters 6.13 & 6.14) and to *Schrödinger's wave equation* of quantum mechanics (chapter 7.2).

The differential calculus involves the two constituents. For instance, the quantity acceleration or electric field is the first derivative of the velocity with respect to time ( $f = 1/dt$ ): a,  $E = dv/dt = [1d\text{-space-time}] f$ . The differential method can be applied to space too, for instance, we can obtain the force from the potential energy as follows:  $F_x = dE_{pot}/dx$ . In this case, the force is usually called the "negative derivative" of the potential energy with respect to the distance  $x$  given as a space vector. The opposite operation is the integration of

the instantaneous force  $F_x$  along the distance  $x$ . It renders the energy as two dimensional space-time. For this reason, Newton's three laws can be presented as energy laws. Due to the common paradigm of geometric expression in physics, any energy interaction between two entities results in a two-dimensional expression of space-time:  $E = SP(A)[2d\text{-space-time}]$  (axiom of reducibility). This allows two concrete applications of differential calculus in physics that have not been clarified from a cognitive point of view.

When space-time is regarded statically (the static view is a necessary prerequisite for the application of mathematics in physics) as  $LRC = [2d\text{-space-time}] = E_{pot}$ , we can obtain the force by building the negative derivative of this quantity with respect to space, which is given as a distance  $[1d\text{-space}]$ . This specific application of differential calculus is called "**building of gradients**":

$$F = -gradE_{pot} = -\left(\frac{\partial E_{pot}}{\partial x}, \frac{\partial E_{pot}}{\partial y}, \frac{\partial E_{pot}}{\partial z}\right) \quad (120)$$

In this sense, the term "gradient" is a synonym for force. The minus-sign is a mathematical convention and can be omitted. Like the force, the gradient is conventionally defined as a vector, while the  $LRC = E_{pot}$ , which is initially called a gradient, is considered to be a scalar. This is a pure convention of geometry without any cognitive relevance.

The operation of "gradient building" is broadly used in physics. When it is applied to three-dimensional Euclidean space, the standard procedure ( $d/dx, d/dy, d/dz$ ) is called **Nabla-operator** and is presented with the symbol " $\nabla$ ". We shall come across this operator in many electromagnetic equations. In terms of geometry, the Nabla-operator renders a vector quantity (force) from a scalar quantity ( $LRC = E_{pot}$ ). When we employ this operator to the LRC, we acquire the **electric field** or the **acceleration** as the negative derivative:

$$E = grad\varphi = \nabla\varphi = \frac{d\varphi}{dr} = \frac{LRC}{r} = \frac{[2d - space - time]}{[1d - space]} = [1d - space - time]f \quad (121)$$

Equation (121) illustrates the significant simplification, which the new space-time symbolics introduces in physics. In fact, it renders the new term Nabla-operator (building of gradients) obsolete - it is a particular application of differential calculus, and this operation has its origin in the Universal Law. We discuss Nabla-operator in this chapter at length because an understanding of

its cognitive background is a prerequisite for an appropriate interpretation of Maxwell's equations of electromagnetism.

The fact that we can obtain a scalar from a vector and vice versa within mathematical formalism has not been fully apprehended so far, although many famous mathematicians and physicists, such as Weierstraß, Cayly, Gauß and Hamilton, have worked on this problem. This finding proves that scalars and vectors are abstract concepts that have no real meaning. The knowledge that physics is applied mathematics and that all physical quantities are abstract terms of mathematics is an achievement of the present axiomatics. In the conventional view, these quantities are considered to be real properties of the physical world. Therefore, for the purpose of "symmetry", it seemed quite logical to develop the opposite operation, with which a scalar can be obtained from a vector. This has led to the introduction of the **Laplace-operator**, symbolized with  $\Delta = \text{div}$  for the LRC or  $\text{div}(\text{grad})$  for the first negative derivative. The symbol " $\Delta$ " should not be confused with the same symbol used for the difference of a quantity, e.g.  $\Delta x$  (ambiguity of mathematical symbolics). This sign is also called "**divergence**". The mathematical operation of divergence is given as:

$$\text{div}(\text{grad})a = \Delta\varphi = \left( \frac{\partial^2}{\partial^2 x}, \frac{\partial^2}{\partial^2 y}, \frac{\partial^2}{\partial^2 z} \right) \quad (122),$$

where  $\varphi = \text{LRC} = U$  is another expression of the energy gradient. The operation of divergence is actually the building of the second negative derivative of the LRC, which is two-dimensional space-time, with respect to space. It results in **square time**:

$$\text{div}(\text{grad})a = \Delta\varphi = \frac{d^2\varphi}{d^2r} = \frac{\text{LRC}}{r^2} = \frac{[2d - \text{space} - \text{time}]}{[2d - \text{space}]} = f^2 = SP(A) \quad (123)$$

There are many quantities in physics that have the dimensionality of square time. For instance, we have shown in chapter 3.7 that **Einstein's cosmological constant** is of the same dimensionality (see exercise 2). Below, we shall present some more quantities that are square time. This quantity results from the two-dimensional presentation of space-time within geometry according to the axiom of reducibility (see also chapter 7.3). The transformation of differential calculus into the new space-time symbolism follows a simple **rule of differentiation**:

In **equations of divergence**, the differential sign  $d^2$  in the numerator expresses the absolute time  $d^2 = f^2$ . When the same sign appears in

the denominator, it stands for  $[2d\text{-space}]$ :  $1/d^2 = 1/[2d\text{-space}]$ . This also applies to **equations of gradient building**. In this case, we set  $d=f$  in the numerator and  $1/d = 1/[1d\text{-space}]$  in the denominator.

The operation of divergence is not applied in a consistent way in electromagnetism. This creates some confusion with respect to the actual dimensionality of the quantities which are introduced by this method. We shall illustrate this problem with a common presentation of the electric field, called **Poisson-equation**:

$$\text{div } E = \Delta\varphi = \rho/\epsilon_0 \quad (124),$$

where  $\rho$  is the volume charge density (115). In this expression, “*div*” is written for the divergence “ $\Delta$ ” with respect to the electric field, although the correct writing should be  $\text{div}(\text{grad})$ . From a formalistic point of view, the operation of divergence should only be applied to the  $LRC = \varphi$  because it is the differential calculation of the second negative derivative with respect to space  $1/[2d\text{-space}]$ , while the electric field is a one-dimensional quantity of space-time. As long as both expressions are written together, the equivalence between the two different expressions is cogent. However, a problem emerges when the first expression stands alone, for instance, when Gauss’s law is given in the integral form (equation (119)):

$$\phi_{net} = \oint_S E_n dA = \oint_V \text{div} E dV = SP(A) [2d - \text{space} - \text{time}] = E \quad (125),$$

in which case we obtain for the net flux the dimensionality of energy  $E = SP(A)[2d\text{-space-time}]$ . The actual dimensionality is, however:

$$\begin{aligned} \phi_{net} &= \oint_V \text{div} E dV = \int_V \Delta\varphi dV = \\ &= SP(A) [2d - \text{space} - \text{time}] \times [1d - \text{space}] = Es \end{aligned} \quad (125a)$$

as presented in equations (119a) and (119b). The differential calculation of gradient building and divergence can be simply expressed in the new space-time symbolism:

1. **Gradient building:**  $\nabla LRC = LRC \times 1/[1d\text{-space}] = E$   
or  $a, g$ ;  
Instead of LRC, we can set any other quantity

2. **Divergence:**

LRC,

$$\Delta LRC = LRC \times 1/[2d\text{-space}] = f^2.$$

This operation should be applied to although it holds for any other abstract quantity

## 6.7 ELECTRIC POTENTIAL

The **electric potential**  $V$  is a central quantity of electricity. It assesses the LRC of electric systems. This quantity is usually given as a **potential difference** of two static values:  $dV = V_1 - V_2$ . This is a mathematical convention, as each of the static values is also a difference - otherwise, it cannot be determined (principle of circular argument). A further term of this quantity is the **gradient** expressed as  $\phi$  or a difference  $d\phi$ . The definition of the electric potential departs from the primary term, which is regarded from a static point of view. The **potential-energy function** is given by the equation:

$$dU = Fdl = q_o E dl = \Delta U = U_b - U_a = \int_a^b q_o E dl = SP(A)[2d\text{-space-time}] \quad (126)$$

The electric potential is defined in a similar manner as the gravitational potential by building a quotient of the potential-energy function and the charge as  $K_s = SP(A) = 1$  according to the principle of circular argument:

$$dV = \frac{dU}{q_o} = E dl = \Delta V = V_a - V_b = \frac{\Delta U}{q_o} = \int_a^b E dl = [2d\text{-space-time}] \quad (127)$$

When we depart from (126) and (127), and the equations in the previous chapters, we can build the following **equivalences between basic SI units**. These equivalences facilitate the transformation of conventional physical formulae into the new space-time symbolism:

$$1V = 1J/1C = 1 \text{ kgm}^2\text{s}^{-2}/\text{m}^2 = 1 \text{ kgs}^{-2} = 1 \text{ m}^2\text{s}^{-2} \quad (128)$$

$$1 \text{ N/C} = 1 \text{ N/m}^2 = 1 \text{ V/m} = 1 \text{ m}^2\text{s}^{-2}/\text{m} = 1 \text{ ms}^{-2} \quad (128a)$$

$$1 \text{ N} = 1 \text{ kgms}^{-2} = 1 \text{ m}^3\text{s}^{-2} \quad (128b)$$

$$1 \text{ A} = 1 \text{ C/1s} = 1 \text{ m}^2\text{s}^{-1} \quad (128c)$$

As already proven, the basic SI units, *volt*, *coulomb* and *ampere* in electricity, *newton* and *kilogram* in classical mechanics, and *joule* in thermodynamics, can be obtained from the two basic SI units, *meter* and *second*, of the constituents, space and time. This **equivalence of the SI units** is of great

practical and cognitive importance. It simplifies advanced physics to the level of basic mathematics and geometry as taught in secondary schools.

Within geometric formalism, there are various assessments and presentations of the electric potential. We shall summarize the most common applications and leave their derivation to the reader (see also exercises below): a) potential due to a system of point charges; b) electrostatic potential energy; c) electric potential for continuous charge distributions departing from a ring, charged disk, continuity, inside and outside a spherical shell of charge, near an infinite line of charge etc. Such applications do not enlarge our cognitive knowledge on the physical world, but only illustrate that mathematics, in this particular case, geometry, is the only adequate perception of space-time.

A basic relationship in electricity is that between the potential as LRC and the electric field as acceleration. By employing the *gradient building* (see chapter 6.6), the electric field is obtained as the negative derivative (gradient) of the potential within differential calculus:  $E = -\nabla V$  and presented in Euclidean space (see equation (120)).

The universality of geometry becomes evident when we analyse how charge interactions are described for practical purposes. The terms introduced for this purpose, such as *equipotential surfaces*, *charge sharing* and *dielectric breakdown*, are circumlocutions for geometric area and for operations dealing with it. We leave the proof to the reader.

*Exercises:*

1. Discuss the method of *xerography* in the light of the new axiomatics. Suggest new applications of the Universal Law for the development of better technologies in this area.
2. Interpret the following definition with respect to the primary term and its parts: “The electrostatic potential energy of a system of point charges is the work needed to bring the charges from an *infinite* separation to their *final* position.”<sup>173</sup>

---

<sup>173</sup> PA Tipler, p. 664

## 6.8 CAPACITANCE, DIELECTRICS AND ELECTROSTATIC ENERGY

Capacitors are useful devices for storing energy. This kind of structural complexity is also basic to the existence of organic life. The *cell membrane* can be roughly regarded as a *closed, spherical, parallel-plate capacitor*. The stored energy on this lipid bilayer is defined as **membrane potential** and can be experimentally measured. The energy exchange of this electric potential is called “**action potential**“ in physiology and plays a central role in cardiology as ECG. We have borrowed this term from physiology for the universal event of energy exchange in the new axiomatics. The reason for this decision is that the Universal Law was first discovered for cell metabolism, which is the basic energy exchange of organic matter, and only then confirmed in physics. In this case, the cell is a system of the cellular level of space-time, and the cellular action potential is the elementary energetic event of this level.

During an action potential, the stored electric energy across the membrane is transformed into chemical, structural energy within the cell, called *metabolism*. The regulation of the cell can be precisely described with the behaviour of the LRC of two contiguous levels - the electric potential of the membrane  $LRC_{el}$  and the rate of metabolism (chemical LRC) of the cell (axiom of reducibility) - to the utmost details of protein structures and function. This allows the development of a **General theory of biological regulation** that is presented in volume III of the present tetralogy of science. For this purpose, we shall pay special attention to some basic formulae of electricity in this chapter, which have been used to evaluate the energy exchange at the cellular level.

The capacitance is a quantity of electric space-time that is derived from the *parallel-plate capacitor*. The ratio between the charge on either plate  $Q$  and the potential established between the two plates  $V$  is conventionally defined as **capacitance**:

$$C = \frac{Q}{V} = \frac{SP(A)[2d - space]}{[2d - space - time]} = \frac{SP(A)}{f^2} = \frac{1}{f^2}, \text{ when } SP(A) = 1 \quad (129)$$

The capacitance is **reciprocal square time** with the actual unit of:

$$1 \text{ farad} = 1 \text{ s}^{-2} \quad (130)$$

This unit is too big for the purposes of electricity. We met the same problem with the unit “coulomb“, which is a pleonasm for one square meter. Therefore the commonly used units of capacitance are *microfarad*,  $1 \mu F$ , and *picofarad*,  $1 pF$ .

The actual magnitude of capacitance is measured by employing a parallel-plate capacitor, the space (charge) and time (capacitance) of which are well defined. However, when we scrutinize the method of measurement of capacitance, we find that it is a hidden definition of the basic electric constant of photon space-time: the *permittivity of free space*  $\epsilon_0$ . In the new axiomatics, we use for the purpose of clarity the reciprocal value of this constant, the *electric field*  $E_0$  of photon space-time (chapter 6.3):

$$C = \frac{Q}{V} = \frac{\epsilon_0 A}{s},$$

hence:

$$E_0 = \frac{A}{sC} = \frac{[2d - space]f^2}{[1d - space]} = [1d - space - time]f = a, g \quad (131)$$

This equation confirms that any method of measurement of a quantity is also the method of its definition. It shows repeatedly that we do not need complex and expensive experiments to obtain information on distant systems and levels of space-time as is done nowadays in astrophysics (space labs) and nuclear physics (cyclotrons). As space-time is a unity, we can employ simple experiments to measure the actual magnitude of any space-time quantity. This is a recurrent motif of this book. Given the ubiquitous loss of common sense in experimental research nowadays at the expense of the tax-payers, causing a tremendous waste in human and material resources and hampering the appropriate development of science and society, the importance of this issue cannot be overestimated.

In electricity, one distinguishes between **conductors** and **dielectrics** (non-conducting materials). This discrimination is arbitrary - the boundary is fluent. The evaluation of the dielectric properties of materials is based on the tacit acknowledgement that all systems of space-time are U-sets that contain themselves as an element. We shall deduce this from the definition of the two basic dielectric quantities, **dielectric constant**  $k$  and **permittivity of the dielectric**  $\epsilon = 1/E$ :

„If the original electric field between the plates of a capacitor without a dielectric is  $E_0 = 1/\epsilon_0$ , the field in the dielectric is  $E = E_0 / k$ <sup>174</sup>, hence  $k = E_0/E$ .

The product of the dielectric constant  $k$  and the permittivity of free space  $\epsilon_0$  “is called the permittivity of the dielectric”<sup>175</sup>:  $\epsilon = k\epsilon_0$ .

---

<sup>174</sup> PA Tipler, p. 695

<sup>175</sup> PA Tipler, p. 695

When we put the two definitions together, we obtain the universal equation as a rule of three:

$$k = \frac{E_o}{E} = \frac{\varepsilon}{\varepsilon_o} = SP(A) = K_{1,2} \quad (132)$$

Equation (132) illustrates the method of building absolute, dimensionless coefficients of energy exchange (see chapter 9.9). The quantity *dielectric constant*  $k$  is such a dimensionless coefficient, also called an “**absolute constant of vertical energy exchange**“. At present, “free space“ is regarded as vacuum. However, it exhibits a quantity, the permittivity of free space, which is interpreted as a “material“ constant, the actual magnitude of which can be experimentally determined (see equation (131)). We are allowed to ask: “How can the void have a definite magnitude? And how can the free space produce a material constant if matter is regarded as an entity opposite to vacuum (free space)?“ The absurdity of this view should be thus cogent to everybody.

The actual idea behind the aforementioned quantities is very simple. It intuitively considers the space which is enclosed between the two plates of the capacitor as a (die)electric system of photon space-time that is characterized by the universal electric quantity  $\varepsilon_o$ , which is the reciprocal acceleration of photon space-time (109). When there is a dielectric between the two plates, we can regard the system resulting from the photon system and the material system as the aggregated set (U-set) of the two interacting U-subsets, the common element of which is energy (space-time). We therefore apply the principle of circular argument and compare the two systems in terms of the quantity “electric field“ according to the axiom of reducibility. This is the cognitive background of the concept of dielectrics (isolators) and their quantities, permittivity and dielectric constant.

Capacitors are adequate devices for the storage of electric energy. Therefore we are not surprised to find that nature has chosen this kind of structural complexity to store energy in organic matter. *Phospholipids* and *cholesterin* arrange spontaneously in ionic solution to *lipid bilayers* (Recall that cell plasma is a ionic solution.). The cell walls constitute of such lipid bilayers. They have the astounding property of sustaining an enormous electric force of about  $4.5 \times 10^7 [Vm^{-1}]$  or  $[ms^{-2}]$  across the cell membrane. This gradient is responsible for the organization of cells and organism (see volume III, chapter 1.2). The formulae used to determine the basic quantities of electricity, such as **electric energy**  $U$ , **potential**  $V$ , **capacitance**  $C$  and **charge**  $Q$ , can be applied to the cell to evaluate the energy exchange (metabolism) of this system. Therefore we introduce these quantities briefly in this chapter:

$$U = \frac{1}{2} \frac{Q^2}{C} = \frac{1}{2} QV = \frac{1}{2} CV^2 = SP(A)[2d\text{-space-time}] \quad (133)$$

These formulae are iterations of well known equations of classical mechanics assessing space-time (see kinetic and potential energy).

Finally, we introduce a basic quantity, which plays a major role in the derivation of the general wave equation of electromagnetism (chapter 6.14) and Schrödinger's wave equation of quantum mechanics (chapter 7.2) - the so called **energy density**  $\eta$ :

$$\eta = \frac{\text{energy}}{\text{volume}} = \frac{1}{2} \epsilon E^2 = \frac{SP(A)[2d - \text{space} - \text{time}]}{[3d - \text{space}]} = \frac{SP(A)f^2}{[1d - \text{space}]} \quad (134)$$

This quantity is identical to *tensile stress* (48) It is of the same origin as *density* (47) and a number of similar quantities, which have been introduced in mechanics. The definition of the energy density reflects the infinite potential of our mathematical consciousness in inventing new quantities of space-time in a vicious circle, which do not enlarge our knowledge of the physical world, but encumber the mind with a futile complexity of mathematical formulae.

*Exercise:*

1. Explain *capacitors in parallel* ( $C_{eq} = C_1 + C_2 + C_3 + \dots$ ) and *capacitors in series* ( $1/C_{eq} = 1/C_1 + 1/C_2 + 1/C_3 + \dots$ ) in terms of U-sets that contain themselves, that is, space-time as an element.

## 6.9 ELECTRIC CURRENT AND SUPERCONDUCTIVITY

In chapter 6.2 we have already discussed the **electric current** in conjunction with its SI unit *ampere*. Now we shall introduce some common applications of this quantity in electricity that are of practical importance. From the method of definition and measurement, the current is an **action potential** of the electric level(s) and systems:  $I = \Delta Q / \Delta t = SP(A)[2d\text{-space}] f = E_A$  (equation (95)). When its unit *ampere* is expressed in the new space-time symbolism, we acquire the following equivalence between *ampere* and the two basic units, *meter* and *second*:

$$1 \text{ A} = 1 \text{ C/s} = 1 \text{ m}^2 \text{ s}^{-1} \quad (135)$$

This is a very useful equation, which helps us to compare the results of electricity with those of mechanics. The electric current usually flows in wires that

can be described as cylinders in terms of geometry. This has led to the following common equation of the current:

$$I = nqAv_d = SP(A)[2d\text{-space}]f \quad (136),$$

where  $n = SP(A)/[3d\text{-space}]$  is the number of free charge-carrying particles per unit volume,  $q = SP(A)[2d\text{-space}]$  is the charge that each particle carries,  $A = [2d\text{-space}]$  is the cross-sectional area of the wire, and  $v_d$  is the drift velocity of the particles. When these quantities are expressed in the new space-time symbolism, we obtain for the *current* in the above equation the dimensionality of an *action potential*.

Further quantities of electricity will be presented in a concise form. One of them is the **resistance**  $R$ , which is a quantity of time  $f$  of the electric systems: "The current in a wire segment is proportional to the *potential* difference across the segment."<sup>176</sup> This is the famous **Ohm's law** as an application of the universal equation:

$$I = \left(\frac{1}{R}\right)V \Leftrightarrow E_A = \frac{1}{f} LRC = \frac{E}{f} \quad (137),$$

where the electric energy  $E$  is regarded statically as  $LRC$ :  $E = LRC$ ,  $SP(A) = 1$ . However, this is a mathematical convention, as the potential difference  $\Delta V = LRC$  presupposes a measurement that should be expressed as  $SP(A)$ . In equation (137),  $SP(A)$  is set as the certain event  $SP(A) = 1$  and does not appear, just as the sign " $\Delta$ " for difference is omitted in the expression of the potential difference  $V$ . This is a typical inconsistency of mathematical presentation, which is inherent in conventional physics. The reciprocal of the resistance  $1/R$  is called a "constant of proportionality". This is a synonym for conventional time:  $1/R = 1/f = t$ . The **resistance** is defined as the ratio of the two basic quantities of the electric system, the electric potential as  $LRC$  and the electric current as  $E_A$  (principle of circular argument):

$$R = \frac{dV}{I} = \frac{SP(A)[2d\text{-space} - \text{time}]}{SP(A)[2d\text{-space}]f} = f \quad (137a)$$

The SI unit of resistance is called "**ohm**" ( $\Omega$ ), which is a synonym for a **reciprocal second**:

$$1\Omega = 1V / 1A = 1 s^{-1} \quad (138)$$

---

<sup>176</sup> PA Tipler, p. 720

The interpretation of the resistance reveals the basic cognitive problems that traditional physics has to combat. The resistance of a given material is said to depend on: (1) its length, (2) its cross-sectional area, (3) the type of material and (4) its temperature. The last quantity is thermodynamic time:  $T = f_{thermo}$ . As all levels contain themselves as an element, the time of the electric level  $R = f_{el}$  should depend on the time of the underlying levels. This is an axiomatic conclusion from the new theory of the Universal Law. The first two quantities are of geometric nature (objects of thought) and do not appertain to real space-time, while the third quantity “type of material“ can mean anything. In the light of the new axiomatics, it is a circumlocution of our fundamental axiom which states that there are infinite levels and systems with a specific constant space-time.

This semantic analysis illuminates the simplicity of the new axiomatics, which is applied logic, in comparison with the traditional view, which is the negation of logic when it is expressed in non-mathematical terms. The new axiomatic approach affords a rigid self-discipline of thinking and linguistic expression - two virtues that have been totally neglected in modern education. This is the crucial problem of most physicists and other scientists when they are initially confronted with the new axiomatics (recall that the English language does not have the word “axiomatics“). It is essentially a psychological problem of a pre-conditioned mind and not so much a question of cumulative scientific knowledge, which we have simplified to an extent that has been generally considered to be impossible in science.

This can be illustrated by another basic quantity of electric space-time, the so called **resistivity**, which is introduced in an empiric manner:

„The resistance of a conducting wire is found to be proportional to the *length* of the wire and inversely proportional to its *cross-sectional area*:  $R = \rho(L/A)$ , where the proportional constant  $\rho$  is called the *resistivity* of the conducting material.“<sup>177</sup>

When we express this quantity in the new space-time symbolism

$$\rho = R \frac{A}{L} = f \frac{[2d - space]}{[1d - space]} = [1d-space-time] \quad (139),$$

we conclude that “resistivity“ is a **specific velocity** of the conducting material - it is a one-dimensional space-time quantity that is a specific constant of each electric system (material). *Quod erat demonstrandum*. The reciprocal of resistivity is called **conductivity**  $\sigma = 1/[1d-space-time]$ . This is the degree of mathematical freedom - we can either use the actual magnitudes or their

---

<sup>177</sup> PA Tipler, p. 721

reciprocals. This elaboration reveals that the electric quantities are pleonasms of the quantities introduced in classical mechanics. Gravitational and electromagnetic levels (fields) are U-sets and cannot be discriminated in real terms, but only within mathematics. They appertain to space-time. This leads to the unification of Newtonian mechanics with Maxwell's electromagnetism (see chapter 6.13). This conclusion will be further elucidated by the exercises below:

*Exercises:*

1. Express the *temperature coefficient of resistivity*  $\alpha$  in the new space-time symbolism and show that it is a quantity of time defined by abstraction  $\alpha = f = f_{el}/f_{thermo}$ .
2. Express *electric energy* and *power* in the new space-time symbolism and apply the new formulae to explain the *electromotive force (emf)* of batteries and other electric sources.
3. Present *series resistors* and *parallel resistors* in the space-time symbolism and explain the formulae with the primary term.
4. Deduce **Kirchhoff's rules** of the circuit in the steady state from the axiom of conservation of action potentials. Describe the following electric systems in the light of the new axiomatics: *RC circuit*, *ammeter*, *voltmeter* and *ohmmeter*.
5. Express the **constant field equation** of cell membrane potential (*Nernst's equation* based on *Gibbs-Donnan equilibrium*) in the new space-symbolism. Calculate the electric energy exchange of a human muscle cell with the *resting potential* of 90 mV (negatively charged) and an *overshoot* of 30 mV during one action potential ( $E = E_A$ ), and at rest (mean heart rate of 72 *beats/min*) for the period of 1 *minute*, 1 *hour* and 1 *day* by employing the universal equation and its applications in electricity as presented above. Consider the energy exchange of the muscle cell as the mean energy exchange of all human cells with the total number of  $2.3 \times 10^{14}$  and estimate the stored electric energy on cell membranes in a human organism. Compare this amount of energy exchange with the average metabolic rate at rest of the human body (6,270 kJ) and calculate the balance of energy conservation by considering the rate of heat (60-65%) conveyed to the surroundings (The solution of the energy balance of the cell and the organism is given in volume III, chapter 1.2.).

### Essay: The Theory of Superconductivity in the Light of the Universal Law

The new axiomatics allows the development of a consistent theory of **superconductivity** that will substitute the present BCS-theory and ultimately lead to the development of adequate superconductors. This new theory of tremendous practical relevance for the future of mankind cannot be discussed in this essay. We shall only present some basic derivations that pave the road to this end.

Evidently, the *resistance* of materials, which is a specific time of the electric level of matter, depends only on the time of the underlying levels, just as the temperature (time) of the thermodynamic level. This follows from the principle of superposition, with which constructive or destructive interference at the electric level can be explained (recall that all electric events are based on the existence of electromagnetic waves; see Maxwell's equations below). Based on *Fourier analysis* and *harmonic synthesis*, we can imagine a mathematical solution that gives us the optimal conditions, under which a "prestabilized harmony" between the various levels of matter and photon space-time will occur.

The problem of superconductivity can be solved by finding the conditions, under which the electric resistance, respectively, the resistivity of the material, approaches zero:  $R = f_{el} = 1/t_{el} \approx \rho \rightarrow 0$ . In this case, the *conductivity* which is a reciprocal of the resistivity, approaches infinity:  $\sigma = 1/\rho \approx 1/R \rightarrow \infty$ . This electric condition, called "superconductivity", which we have derived in an axiomatic manner from the Universal Law, was first observed by *Onnes* in 1911 for materials below the **critical temperature**  $T_c$ , about at the time when the **classical model of electric conduction** was established by *Lorentz* (1909) based on the work of *Drude* (1900).

The subsequent theory of superconductivity, the so called **BCS-theory** (for *Bardeen*, *Cooper* and *Schrieffer*) developed in 1957 is based on Lorentz' classical theory of conduction. The latter departs from Boltzmann's statistical method of thermodynamics. The history of the discovery of superconductivity illustrates how physics has evolved empirically from a single experience to a general idea of the Universal Law, but it also proves that the empiric approach is a deadlock.

The BCS-theory is, in fact, a hypothetical model that fails to explain the conductivity in *ceramic oxides* at much higher temperatures, a phenomenon that was coincidentally observed by *Müller* and *Bednorz* in 1986. The euphoria triggered by this finding was subsequently cooled down to the initial critical temperatures of superconductivity (around  $0^\circ K$ ) because of the brittleness of the ceramic materials that hampers the practical use of these superconductors. After that, there has been no major breakthrough in the area of superconductors with the propensity of revolutionizing energy consumption. We shall now outline the new theoretical approach of the Universal Law that

will ultimately solve this problem at the practical level. We shall begin with **Lorentz' theory of conductivity**, which is basic to the present BCS-theory.

Like Boltzmann's kinetic theory of gases, Lorentz considers the charged particles as an assembly of kinetic particles (electron gas theory) that can be statistically described by the **root mean square velocity**:

$$v_{rms} = \sqrt{\frac{3kT}{m_e}} = [1d\text{-space-time}]$$

which is one-dimensional space-time quantity of the electron level. This approach tacitly selects the electrons as representative systems of the microscopic electric level of matter (reductionist approach), although all other elementary particles and molecules of matter also have a charge, that is, area (space), and should be taken into consideration too. The kinetic motion of the electrons is described in terms of the **collision time**  $\tau$  by employing the classical paradigm of "elastic collision" as a closed system (N-set). This approach explains the limited character of this theory. The collision time is the reciprocal time of the **kinetic electron level**  $1/\tau = f_{el} = v_{av}/\lambda$ , where the **mean free path**  $\lambda$  is the constant [1d-space]-quantity of this level. Recall that anything we can do in physics is to determine the space, time, or space-time of the systems or levels. Departing from equation (136), the **resistivity** (139) can be expressed in terms of the mean free path  $\lambda$  and the mean speed  $v_{av}$  as follows (see chapters 3.9 & 6.2):

$$\rho = \frac{m_e v_{av}}{ne^2 \lambda} = \frac{m_p f_{c,e} f_{el}}{nq_p^2 f_{c,e}^2} = \frac{m_p f_{el}}{nq_p^2 f_{c,e}} = \frac{m_p f_{el}}{neq_p} = [1d - space]f = v_{el} \quad (140),$$

$$\text{when } 1/SP(A) = 1,$$

where  $SP(A) = SP(A)_e SP(A)_{qp}$  (see above), and  $f = f_{el}/f_{c,e}$  is the resultant time as a function (quotient) of the time of the kinetic electron level and the intrinsic time (Compton frequency) of the electron. Equation (140) reveals that all levels are open U-sets, so that their space-time can be assessed in relation to other levels. It also confirms that the electric resistivity depends on the mass (relationship of energy)  $m_p$  and charge (area)  $q_p$  of the basic photon  $h$  and the *mean constant time*  $f_{el}$  of the corresponding electron level.

Superconductivity is defined by the conditions,  $T_c$  and  $R = 0$ . Both are quantities of time. Under these boundary conditions, the electric current that has been initiated can flow in ring conductors for a very long time without any external potential maintaining the current. This means that the electric energy is practically inexhaustible, as the losses of electric energy will approach zero:  $E_{loss} = I/dt = E_A f \rightarrow 0$ , when  $dt = 1/f \rightarrow \infty$ . In the state of superconductivity,

the energy exchange with the other contiguous U-levels of matter is reduced to a minimum so that the electric level can be regarded as an almost closed level. This is the current cognitive approach of the BCS-theory to superconductivity. It disregards the fact that all levels are open so that the *kinetic electron level*, being selected as representative for the electric level of matter, is only approximately closed under the condition of superconductivity. This level exchanges most of its energy with the contiguous thermodynamic level of matter (chapter 5.3), which, on its turn, interacts with the thermodynamic photon level (see Stankov's law, chapter 5.7), that is, it emits most of the thermodynamic energy as radiation that is definitely lost for practical purposes. The availability of energy, which has been tackled in conjunction with the second law of thermodynamics (chapter 5.6), also holds in superconductivity.

The availability of energy is, indeed, the major problem of transmitting electric energy over long distances. Currently, this problem has been solved by the use of *high-voltage, alternating currents*, with which the energy losses in heat and subsequently in radiation to the photon space-time (see laws of radiation, chapter 5.5) can be reduced, although the rate of energy losses is still substantial. The solution of this practical problem is to find the optimal frequency (time) and potential (LRC) for a given conductor (space-time of the mediator) that allow the energy exchange with the thermodynamic level and the photon level to become minimal. This condition is now circumscribed as "superconductivity". The research in this field is at present reduced to the random search for new materials with this property. Hence the deadlock in this research area.

The problem of developing new superconductors that are not brittle and have a normal  $T_c$  can be tackled in a successful way when the energy exchange with the adjacent levels is considered. Only by employing the **broad** approach of the new axiomatics of the Universal Law can we solve the crucial problem of superconductivity, on which the future of mankind will depend. This has already been demonstrated by the novel equation of the resistivity (140). It shows that the resistivity is proportional to the product of the mass of the basic photon and the specific time of the electric level  $\rho \approx m_p f_{el}$ , and inversely proportional to the collision time:  $\rho \approx m_p / \tau$ . Thus the solution of the problem of superconductivity is to find a method of decreasing the specific time of the kinetic electron level  $f_{el}$  (increase of the collision time of the electrons) in order to reduce resistivity. One possible way of achieving this target is to reduce the time of the thermodynamic level to the critical value of  $T_c$ , at which the amount of the exchanged energy between this level and the electric level as determined by  $K_{av} = 3/2k_b T_c$  becomes minimal.

We should bear in mind that the frequency of the maximal energy exchange with the photon level depends on  $T$ :  $f_{max} = K_{CBRT}$  (equation (82)). A decrease in  $T$  will minimize the energy exchange between the thermodynamic level of matter and that of photon space-time. This portion of energy is

lost for practical use and determines the availability of energy to mankind. The thermodynamic energy emitted to the photon space-time as assessed by Stankov's law (5.7) is lost for practical purposes as demonstrated by Carnot cycle. The other alternative is to modulate the crystal structure of the conducting material in accordance with the horizontal and vertical energy exchange between the levels of matter and between matter and photon space-time with the objective to reduce  $K_{av}$ . The solution of this mathematical problem through computer simulations is beyond the scope of the present essay. Here, we only point at the epistemological shortcomings of the present BCS-theory.

They begin with the concept of **Fermi-energy**. The problem with the classical model of **free electron gas** lies in the assumption that the mean kinetic energy of electrons is  $K_{av} = 3/2k_bT$ . This equation is obtained within geometric formalism by making certain assumptions (see chapter 5.3) that have not been proven to be true for the electron, which has a different structural complexity to that of the particles at the thermodynamic level. At present, the electron is regarded as a hemisphere with the surface of  $m_B = 1/2\pi\lambda_{c,e}^2$  called *Bohr magneton* (see equations (100) & (102)), or with the *cross-sectional area* of  $e = 2\pi^2f_{c,e}(\lambda_{c,e}/\lambda_A)^2$ , called "charge" (equation (104)). These geometric quantities are important to the theory of superconductivity. This is, however, speculative geometry applied to the quantum level, to which we have no direct access. In this particular case, the ideal geometric form of a sphere or circle is *ad hoc* attributed to the electron. These forms presuppose a closed character of the systems, e.g. no doppler effect with the photon space-time. Therefore, they cannot adequately assess the open character of the electron (see chapter 7.1) or any other particle (see chapter 4.8).

According to the BCS-theory, at the critical temperature of  $T_c$  the electrons become bound in pairs, called **Cooper-pairs**. This term is a circumscription of the condition, under which the collision time becomes infinitely great and superconductivity occurs: when  $\tau = 1/f_{el} \rightarrow \infty$ , then  $\rho \rightarrow 0$ . In any Cooper-pair, the two electrons have an *opposite spin* so that the total spin of the pair is zero. What is the epistemological background of these descriptive statements? As already said, each system of space-time can be regarded as a rotation which is the origin of waves (chapter 3.4 and section 4.) or, alternatively, as a rotational wave (de Broglie's interpretation of Bohr's quantization model of the electron; see chapter 7.1). The term "spin" is a synonym of the **own angular momentum** of the particle  $L = mvr = mr^2\omega$  (24) that is expressed in terms of the *moment of inertia*  $L = I = mr^2$  (22), when the angular velocity, also called angular frequency, is regarded as the certain event:  $\omega = SP(A) = 1$ . This means that the term "spin" is introduced with respect to one revolution of the internal rotation of the particle which is expressed as a structural complexity, that is, as an area:  $L = E_{A,particle} = I = K_s = SP(A)[2d-space] = SP(A) = 1$ . This is a common method of magnetism (see magnetic moment in chapters 3.9 & 6.11) and quantum mechanics (chapter 7.1). Hence the key role of wave

theory in assessing the space-time of rotations (chapter 3.4). As the electron is geometrically regarded as a hemisphere, we have, in fact, only half of a revolution of this particle, so that the spin of the electron is given as  $\frac{1}{2}$  (**fermion** due to Pauli exclusion principle, asymmetrical function of Schrödinger's equation etc.). Formally, this is expressed as follows:

$$electron - spin = \frac{1}{2} \hbar = \frac{h}{4\pi} = \frac{m_p \lambda_A^2}{4\pi} = circle - area = \frac{circumference^2}{4\pi}$$

(141)

In this equation, the **electron spin** ( $1/2$ ) is defined geometrically as the **area of a circle** with respect to the square circumference  $\lambda_A^2$  and the mass  $m_p$  of the basic photon  $h$ . Their product is expressed as  $K_s$  within geometry, which is the method of definition of this quantity:  $electron\ spin = K_s = m_p \lambda_A^2 = SP(A)[2d-space]$ . Equation (141) embodies the geometric (mathematical) origin of some of the most important terms and quantities in physics and, in particular, in quantum mechanics. This is the epistemological background with which the basic statements of the BCS-theory can be interpreted in a novel way.

When the BCS-theory postulates that the two electrons of a Cooper-pair have opposite spins, so that their total spin is zero, this simply means that the two rotational systems exchange energy exclusively between each other (horizontal energy exchange), while the vertical energy exchange with the contiguous levels is zero. In this sense, the Cooper-pair is regarded as a closed system. Evidently, this is an idealisation born in the realm of geometry and visualized with the help of two hemispheres, which are believed to build an ideal sphere, while revolving in opposite directions, so that the energy of the resultant rotational system that should enter in further exchange with other levels of matter is zero. If we consider the reality, namely, that the two electrons cannot be ideal hemispheres, but, say, build as a Cooper-pair an elliptical form that is rotating eccentrically, we immediately realize that there is always a certain energy exchange between the Cooper-pairs and the other levels of matter, for instance, with the molecular, crystal structure of the thermodynamic level. The spatial solutions of Schrödinger's wave equation of quantum mechanics as used in chemistry and further developed by *Hückel* and other chemically orientated physicists acknowledge the fact that electrons expressed by *molecular orbit* or *covalent bonding* are never spheres when they are part of the molecular structure. As any further discussion on this issue is beyond

the scope of the present essay, we recommend the reader to scrutinize the problem from the point of view of physical chemistry<sup>178</sup>.

Other statements of the BCS-theory can be tackled by the same epistemological approach. For instance, this theory maintains that the magnetic field in a superconductor is zero. This condition is called **Meißner-Ochsenfeld-effect**. In the next chapter, we shall prove that the *magnetic field* is a quantity of time:  $B = f$ . When the magnetic field (time) approaches zero, superconductivity is observed. This condition has been deduced from equation (140) for the time of the kinetic electron level  $f_{el}$ . As this electric level cannot be separated from the magnetic level (U-subsets of space-time) - hence the term electromagnetism - Meißner-Ochsenfeld-effect iterates our conclusion from the novel derivation of the equation of Lorentz' classical model of electric conduction. This is another convincing proof for the validity of the new axiomatics with respect to any experimental evidence. This will be substantiated by further examples.

The decrease of the magnetic field takes place stepwise through different phases, called **Schubnikov phases**. This phenomenon is a manifestation of the discrete character of space-time. It has also been found that one needs a definite quantity of energy to break the Cooper-pairs at  $T_c$ . This amount of energy is called **superconductor-energy gap** and is given as  $E_g = 3.5k_bT_c$  with respect to the thermodynamic level. As we see, the BCS-theory tacitly considers the vertical energy exchange of the electric level with the thermodynamic level, but it is not in the position to interpret this vertical energy exchange in terms of knowledge. Instead, it introduces the Cooper-pairs as closed systems of elastic collision, by assuming that the aggregated linear momentum of all pairs in a superconductor is zero. According to the BCS-theory, when an external potential is applied to a superconductor, the Cooper-pairs acquire a linear momentum, which does not dissipate. The inadequacy of this paradigm is a recurrent motif of this book.

The BCS-theory cannot ignore the discrete character of space-time. For this purpose, it introduces a new quantity, called the **magnetic flux quantum**, which is regarded as the smallest constant energy quantum, that is, as the **basic action potential** of the magnetic level:

$$\phi_m = \frac{h}{2e} = \frac{m_p \lambda_A^2 f_p}{2q_p f_{c,e}} = \frac{m_p \lambda_A^2}{2q_p f_{c,e}} = \frac{1}{2} \times \frac{K_{s(mass)}}{K_{s(charge)}} \times \frac{[2d - space]_p}{f_{c,e}} = E_A$$

$$\text{as } f_p = 1, (142),$$

---

<sup>178</sup> For further reading see, for instance, M Carplus & RN Porter, *Atoms and molecules*, 1970, and F Vögtle, *Supramolekulare Chemie*, Teubner, Stuttgart, 1992.

where  $f = f_p / f_{c,e}$  and  $K_{s(mass)} / K_{s(charge)} = SP(A)$ . The magnetic flux quantum is a quantity of photon space-time that will be discussed in detail in chapter 6.12 (see Gauss's law of magnetism and Stokes' integral form of Ampère's law). Equation (142) reveals that this basic action potential of the magnetic level is a function (quotient) of the basic action potentials of the photon level ( $h$ ) and the electric level ( $e$ ) according to the principle of circular argument. It is an application of the axiom of conservation of action potentials.

Equation (142) confirms our basic conclusion, namely, that we can only solve the problem of superconductivity, if we consider the overall energy exchange between the various levels of matters, as well as that between matter and photon space-time. This can only be done in the light of the Universal Law. This conclusion rejects the present deterministic and reductionist approach in the field of superconductivity that has failed in theory - BCS-theory, and in practice - the development of cheap superconductors that are not brittle and can run at normal temperatures<sup>179</sup>.

## 6.10 THE MAGNETIC FIELD

Although **magnetism** has been known in ancient Greece and subsequently observed on many occasions, it was only in the nineteenth century that the connection between magnetism and electricity - two U-subsets of space-time that cannot be separated in real terms - was intuitively realized (Oersted, Ampère, Henry). This insight led to the development of **electromagnetism** by Maxwell (about 1860). The established view on electromagnetism dates from this time:

„Ampère proposed a theoretical model of magnetism that still serves as the basis of the modern theory of magnetism. He speculated that the fundamental source of magnetism is not a magnetic pole but rather an *electric current*... Today, we know that these *current loops* result partly from the *motion* of electrons within the atom and partly from *electron spin*, a quantum-mechanical property of the electron. The basic magnetic interaction is the magnetic force one *moving* charge exerts on another *moving* charge. This force is *in addition* to the electric force between charges. As with the electric force, we consider the magnetic force to be transmitted by another agent, the *magnetic field*.“<sup>180</sup>

---

<sup>179</sup> As superconductivity is an inherent property of matter, the development of appropriate superconductors will not result from experimental research, as is believed today, but will only be possible after an axiomatic reorganisation of the scientists' mind has taken place. The implications of this mental revolution for science and society are beyond the scope of this volume.

<sup>180</sup> PA Tipler, p. 782

This quotation summarizes the present knowledge on magnetism, respectively, on electromagnetism, which can be interpreted within the new axiomatics as follows:

1) The terms **electricity** and **magnetism** describe two levels of space-time as U-subsets that are interdependent and exchange energy. Magnetism results from electric currents (motion is the universal manifestation of energy exchange) within the level of matter. The motion of the electric currents are **rotations** that superimpose. For instance, the electron spin is a synonym for the intrinsic rotation of this particle (see essay on superconductivity), and not a specific quantum quantity, as is believed today. Since the electron rotates in addition at the molecular level, this particle, considered to be the carrier of electricity and magnetism in matter, can be regarded as a **superimposed rotation**. Such rotations can be described by applications of the universal equation (chapter 3.4). We shall show in chapter 7.1 that Bohr's model of electron quantization can be reduced to a mathematical evaluation of a superimposed standing wave by applying the Universal Law. The term "electric current" is a circumscription of an electric action potential at the level of matter, which is defined as the motion of particles (charges), in particular, of electrons. The electron level can be subdivided in many levels that superimpose (U-sets, infinity of space-time).

2) The term "magnetism" describes an interaction between **moving** charges (see below), while "electricity" describes an interaction between **static** charges (Coulomb's law). This is an abstract discrimination within the realm of mathematics (geometry), which emerges from the method of definition of the quantities used in each specific derivation of the Universal Law. In reality, all systems and levels are in an incessant motion. The paradigm "charge (area) in motion" assesses this intrinsic property of space-time. Therefore we can conclude that "electricity" (static) and "magnetism" (motion) merely embody the fundamental dualism of present physical outlook and should be regarded as an entity - hence the term "**electromagnetism**".

3) The term "electromagnetism" includes the vertical energy exchange between matter and photon-space time. This has been intuitively felt by introducing the concept of the "**magnetic field**" analogously to the concept of the "electric field". However, while the latter has the dimensionality of acceleration  $E = [1d\text{-space-time}]$ , the magnetic field is defined as a *quantity of time*:  $B = f$ . Thus magnetism introduces the constituent time as a basic, dynamic quantity of energy exchange.

This epistemological analysis of the basic terms of magnetism significantly facilitates our subsequent discussion of the physical quantities that have been traditionally introduced in this area. Although we have proved that it is not

possible to distinguish between electric and magnetic levels in real terms, we shall stay in line with the traditional view in this chapter and discuss the magnetic level as a distinct entity. In the theory of magnetism, the magnetic field is defined through the magnetic force, just as the gravitational field in classical mechanics. Physics as applied mathematics, is, indeed, a highly iterative science.

The method of definition and measurement of the **magnetic force** is geometry and algebra, and is based on the following experimental evidence: 1) the magnetic force, also called **Lorentz force**, is proportional to the charge (area) of the particles:  $F \approx q = K_s$ ; 2) The force is proportional to the speed:  $F = SP(A)[1d\text{-space-time}]f \approx v = [1d\text{-space-time}]$ ; 3) The force  $F$  is also proportional to  $\sin\theta = 0 \leq SP(A) \leq 1$ , where  $\theta$  is the angle between the velocity  $v$  and the magnetic field  $B$  expressed as vectors  $F \approx 0 \leq SP(A) \leq 1$ . 4) If  $v$  is *parallel* or *antiparallel* to  $B$ , the force is zero:  $F = \sin 0^\circ = SP(A) = 0$  (improbable event). 5) If  $v$  is *perpendicular* to  $B$ , the force is perpendicular to both vectors:  $F = \sin 90^\circ = \pi/2 = SP(A) = 1$  (the certain event).

As we see, the experimental evidence of magnetism leading to the introduction of the *magnetic force* and the *magnetic field* can be axiomatically obtained from the primary term within mathematical formalism (empiricism as a tautology of the Law). The method of definition and measurement of the magnetic quantities is the **sine-cosine function**, which is another mathematical presentation of the continuum (chapter 3.1) and is broadly used in wave theory. It reveals the well known fact that (electro)magnetism is of wave character. The above relationships can be summarized in a simple equation of the **magnetic force**, from which the dimensionality of the **magnetic field** can be easily determined:

$$F = qv \times B \text{ or } B = \frac{F}{qv} = \frac{SP(A)[1d\text{-space-time}]f}{SP(A)[1d\text{-space-time}]} = f \quad (143)$$

The magnetic field is a particular quantity of space-time. This equation is usually presented in 3d-Euclidean space by employing “manual power“ - by the so called “**right-hand rule**“. This rule exemplifies the many obsolete procedures which one encounters in physics. The SI unit of magnetic field is “**tesla**“ (**T**) - it is a synonym for the *reciprocal* of the basic SI unit of conventional time, 1 *second*:

$$1 \text{ tesla} = 1 \text{ s}^{-1} \quad (143a)$$

This equivalence has not been comprehended so far and has led to some awkward interpretations that may transpire to be of great embarrassment to physicists. For instance, the *magnetic field* of the *earth* is calculated to be in the magnitude of  $10^{-4}$  tesla, which is equivalent to  $10^4$  *seconds*:

$$B_{earth} = 10^{-4} \text{ tesla} = 10^4 \text{ s} \quad (144)$$

For this reason,  $B_{earth}$  is considered to be very weak. In fact, the magnetic field tells us how often an action potential is repeated when the universal equation is applied:  $E = E_A f = E_A B_{earth}$ . As the earth is a rotating system, we can set for its action potential the angular momentum of the earth  $L_{earth} = E_A$  (24) expressed as an area (moment of inertia),  $K_s = I_{earth} = SP(A)R^2$  ( $R$  = earth's radius), for one rotation around its axis:  $\omega = f = B_{earth} = 1$  (22). If we now express the time of one rotation of the earth  $f = B_{earth} = 1$  with the SI unit, 1 *second*, we obtain the time of the earth's rotation as a pure number:  $f = B_{earth} = 1/t = 1 \text{ day}/1s = 8.64 \times 10^4 \text{ s}/1s = 8.64 \times 10^4$ . In conventional terms, the time the earth takes for one rotation  $f = 1$  is equivalent to  $8.64 \times 10^4$  *seconds*:  $f = 1 \text{ (rev)} = 8.64 \times 10^4$  (*seconds*), e.g. 1 billion \$ is equivalent to 1 000 000 \$. This time is almost equivalent to the experimentally measured magnetic field of the earth in tesla:

$$B_{earth} = 10^{-4} \text{ tesla} \approx 8.64 \cdot 10^4 \text{ seconds} \quad (144a)$$

Instead of measuring the magnetic field of the earth, scientists have practically measured the number of seconds in one day, which is equivalent to one revolution of the earth around its axis, without the faintest idea that they are committing an awkward mistake. How can we explain the small difference between *teslas* and *seconds* in equation (144a)? The duration of the day, respectively, of the SI unit 1 *second*, is defined in terms of the solitary revolution of the earth around its axis and neglects the superimposed rotation of the earth around the sun, the rotation of the solar system around the centre of the galaxy, the rotation of the Milky way around the local group, and so on. The magnetic field gives, instead, the **aggregated time** of this superimposed rotation of the earth. Therefore, the aggregated rotational time (in *tesla*) is slightly different from the time of the earth's rotation around its axis when the latter is regarded as a solitary motion (one day in seconds). The resultant axis of the superimposed rotation is also different from the earth's own axis. Hence the different location of the earth's magnetic pole with respect to the North pole<sup>181</sup>. This example illustrates both the empiric power of the new axiomatics - its ability to explain any phenomenon in a consistent way -, and the cogni-

---

<sup>181</sup> In the last few years, scientists have established that the magnetic pole is rapidly changing its position and is moving in south-east direction, however, without presenting any explanation for this remarkable phenomenon. Without going into details, we shall only hint that this change in the position of the magnetic pole reflects a profound change in the superimposed rotation of the earth due to significant energetic changes of this planet that will soon become visible to mankind.

tive blindness of traditional physics even on such simple issues of tremendous practical importance as the earth's magnetism, for instance, in navigation.

Equation (143) is the departing point of several derivations of the universal equation within magnetism, which assess actual (electro)magnetic systems from the geometric point of view. We shall present one such application: the **torque** (see equation (21)) of current loops and magnets:

$$\tau = m \times B = mB = (NIAn)B = SP(A)[2d\text{-space-time}] \quad (145),$$

where  $m$  is called the **magnetic moment** of the current loop (not to be confused with mass),  $N$  is the number of turns,  $A$  is the area of the loop,  $I$  is the current in the loop, and  $n$  is a unit vector. The product  $NIAn$  is defined as the *magnetic moment*. We shall derive this quantity in chapter 6.12 from the angular momentum, while discussing the concept of electromagnetism of matter. From equation (145), it becomes evident that this quantity is defined as an action potential:  $m = \tau/B = SP(A)[2d\text{-space}]f$ . One can obtain the same dimensionality for the magnetic moment when one departs from the product  $m = NIAn$  and considers its definition within geometry. We leave this exercise to the reader. The above equation confirms that all electromagnetic systems can only be assessed as rotations - for instance, torque is a synonym of rotating space-time (see chapter 3.4, equation (21)).

Like the electric field, the magnetic field is also depicted by **magnetic-field lines**. This geometric presentation is a pure abstraction and has no correlate in the real world. The link between the two fields is obtained by the velocity of the electric system (charge), which is one-dimensional space-time of the particle:

$$v = \frac{E}{B} = \frac{[1d\text{-space-time}]f}{f} = [1d\text{-space-time}] \quad (146)$$

This is another iteration of the universal equation for the velocity as one-dimensional space-time. The development of the concept of magnetism has also produced a useful relationship between the charge of the electron and its mass (*Thompson's measurement*), which is an application of the universal equation as a rule of three:

$$\frac{q}{m_e} = \frac{SP(A)[2d\text{-space}]_{charge}}{SP(A)[2d\text{-space}]_{mass}} = \frac{SP(A)_{area}}{SP(A)_{energy-relation}} = SP(A) \quad (147)$$

This quotient has played a central role in the development of the theory of relativity, first in electromagnetism (Lorentz) and then in the special theory of relativity (Einstein). This will be discussed in detail in chapters 8.2 and 8.3. Equation (147) is the method of definition of the **mass spectrometer** (priority

of theory over empiricism), which is a basic instrument of modern chemistry. It is used to find the **mass-to-charge ratio** of ions of a known charge (area) by measuring the radius of their circular orbits in a uniform magnetic field:  $r = mv/qB$ . When this formulae is solved for the charge-mass quotient in (147), we realize why experimental research is a tautology of the Universal Law - it always assesses the continuum or the probability set, that is, the primary term:

$$\frac{m}{q} = \frac{B^2 r^2}{2\Delta V} = \frac{f^2 [2d - space]}{2[2d - space - time]} = SP(A) = continuum \quad (147a)$$

This example illuminates how the mathematical method of definition of quantities is introduced as a method of measurement in research - a fundamental theoretical aspect of science that has remained cryptic to physicists until the discovery of the Universal Law. It focuses on the central conclusion of the new axiomatics, namely, that any experimental result is part of the continuum (the set of all numbers), so that this abstract term of mathematics is equivalent to the primary term.

The tautological character of any experimental research can be illustrated by another expensive toy of physicists, financed by the aggregated product of the taxpayers - the **cyclotron**. It was invented by Lawrence and Livingston in 1932 to accelerate particles, such as protons or deuterons, to high kinetic energies, which are “then used to bombard (we prefer the less martial term “interact”) atomic nuclei to cause nuclear reactions that are then studied to obtain information about the nucleus<sup>182</sup>. Ever since these superfluous experiments have begun, they have rendered no true progress in our knowledge of nature, but much a confusion that persists to the present day:

„It was expected that only protons and neutrons would come out. But when the energies become sufficiently large, new particles came out. First there were pions, then lambdas, and sigmas, and rhos, and they ran out of the alphabet. Then came particles with numbers (their masses), such as sigma 1190 and sigma 1386. It soon became clear that the number of particles in the world was *open-ended*, and depended on the amount of energy used to break apart the nucleus.“<sup>183</sup>

---

<sup>182</sup> PA Tipler, p. 795

<sup>183</sup> RP Feynman, QED, p.132. For this reason, a large investment programme of new cyclotrons was recently stopped by the USA senate. Europe, being traditionally slow in comprehending new developments, still wastes huge amounts of money on cyclotrons and the like (e.g. Garching reactor in Munich). Nuclear research is insofar useless, as it has no practical objectives, for instance, the development of new adequate sources of energy, such as artificial photosynthesis. Therefore, it is not at all

This result is covered by the axiom of conservation of action potentials:  $E_{A1} = E_{A2}$ . As we can regard each particle (system) as its own action potential, the space-time of the resultant particle (action potential) is equivalent to the energy (action potential) applied. This is an open-end story because space-time is infinite. The misapprehension of this ubiquitous fact is the central flaw of the protagonists of the standard model in physics: their reductional view of the physical world as an assembly of a few elementary particles - be they quarks or "Käse"<sup>184</sup> - is for this reason a deadlock. However, space-time (energy) always obeys the Universal Law - reducing the plurality of systems and phenomena to a single law is the only possible way to simplify our outlook of nature, as is the case with the **kinetic energy of cyclotrons**, which is an application of the universal equation:

$$E_{kin} = \frac{1}{2} \left( \frac{q^2 B^2}{m} \right) r^2 = SP(A)[2d\text{-space-time}] \quad (148)$$

*Exercises:*

1. Use equation (148) to derive the *cyclotron frequency* (time of the system) and express its formulae in the space-time symbolism. Explain why cyclotron-formulae can also be derived from Newton's second law. Establish the equivalence between classical mechanics and magnetism in terms of their method of presentation (mathematics).
2. Derive the magnetic force in the equation  $dF = Idl \times B$ , where  $Idl$  is called the **current element**, from the universal equation.

---

surprising that this kind of research has not yielded any practical innovation. This fact elucidates the bankruptcy of fundamental physical research in the 20th century.

<sup>184</sup> This is a play of words: The German word „Quark“ means „curd milk“ and the German translation of milk is „Käse“. The German idiom „that's Käse“ (das ist Käse) means “that's rubbish“. This is the exact definition of quantum chromodynamics, QCD, and its futile search for quarks and other elementary particles in expensive cyclotrons.

## 6.11 THE QUANTUM HALL EFFECT (ND)

The magnetic force which an electromagnetic photon system exerts on a current-carrying wire (material electric system) acts on the microscopic carriers of the electric current - the electrons. This results in a separation of charges (electrons and ions), called the **Hall effect**. This phenomenon describes the vertical energy exchange between a photon system and an electric material system. Such an interaction can be precisely interpreted in terms of the reciprocal behaviour of the LRC of two contiguous levels ( point 44.), which is a basic axiom of application of the new axiomatics.

The separation of the charges leads to the building of the **Hall voltage**  $V_H$ , that is opposite to the *magnetic force*  $F=qv_d \times B=qE$  (equation (143)), where  $v_d$  is the drift velocity of the charge carriers and  $E=v_d \times B = [1d\text{-space-time}] f$  is the electric field or acceleration of the photon system (equation (107)). When we consider the width  $w$  of the wire strip, we can express the space-time of the photon system in terms of its **electromagnetic potential**  $V_m$  or **LRC<sub>m</sub>**:

$$V_m = LRC_m = wE = wv_d \times B = [2d\text{-space-time}]_m \quad (149)$$

This LRC is equivalent to the **Hall voltage** in magnitude, but opposite in direction (axiom of conservation of action potentials):

$$V_H = LRC_H = wE = wv_d \times B = [2d\text{-space-time}]_m \quad (149a)$$

The Hall voltage is the LRC of the material electric level, which is reciprocal (canonically conjugated) to the electromagnetic potential of the contiguous photon level. This is an aspect of the reciprocity of space and time. In terms of mathematics, this physical relationship can be expressed by using the minus sign,  $V_H = -V_m = -wE$  or the number "1" for reciprocity. Both methods of expression are equivalent abstract conventions of mathematics in respect of human cognition. In the present case, we regard the electromagnetic photon level and the electric material level as two U-subsets of space-time that contain themselves as an element. They build a new system (level), the space-time of which can be assessed according to the principle of reducibility and expressed in terms of statistics as the certain event (method of definition and measurement):

$$V_H V_m = SP(A) = 1 = \text{certain event}, \quad \text{or} \quad V_H = 1/V_m \quad (150)$$

Equation (150) gives the reciprocal character of the two LRC of the resultant system as a quotient. We should be aware of the fact that we can assign any

other number to the resultant system  $SP(A) = 1/n$  without affecting the real content of this formula.

This reciprocity can be presented in many different ways depending on the quantities used. For instance, instead of the Hall voltage we can consider the electric current,  $I = nqv_dA = nqv_dwt$  (47), where  $n = SP(A)/[3d-space] = \rho$  is the number of moving charges (areas) per unit volume in the wire strip with the cross-sectional area of  $A = wt$  ( $t$  is thickness of the wire strip). The geometric approach is cogent. When the formula of the current is rearranged by substituting  $v_dw = V_H/B$  from equation (149a), we obtain for the **number of moving electron charges or areas** ( $q = e$ ) the following practical equation that can be experimentally verified:

$$\begin{aligned} n &= \frac{IB}{etV_H} = \frac{SP(A)[2d - space - time]}{SP(A)[2d - space] \times [1d - space] \times [2d - space - time]} = \\ &= \frac{SP(A)}{[3d - space]} \end{aligned} \quad (151),$$

where  $SP(A) = SP(A)/SP(A)$ . Equation (151) is a mathematical iteration of the formulae of the Hall voltage (149a) and the electromagnetic potential (equation (149)) and gives the *density* of the electric system (equation (47)).

The Hall effect assesses the energy interaction between any electromagnetic photon system and any material electric system at the macroscopic level - the Hall voltage is the macroscopic aggregated product of the electric microscopic interactions at the particle level. These interactions are assessed by the **quantum Hall effect** as first described by *Klaus von Klitzing*, for which he received the Nobel prize in 1985. When the  $LRC_H = V_H$  of the material electric system is given as a function of the time of the electromagnetic photon system, the magnetic field  $f_m = B$ , the plot of  $V_H$  results in a series of plateaux indicating that the Hall voltage is **quantized**. Energy (space-time) is always quantized - it manifests itself in constant action potentials. Thus the quantum Hall effect is a tautological experimental confirmation of our axiomatic conclusion concerning the inhomogeneous character of space-time, just as most achievements in science awarded with the Nobel prize are unanalyzed, subconscious tautologies of the Universal Law within the realm of mathematics. It is, indeed, an irony that Nobel deliberately excluded mathematics from his award.

The quantization of Hall voltage is expressed by the so called **von Klitzing constant** which is given as a ratio of the basic photon and the electric charge (principle of circular argument) and has the dimensionality of the resistance (137a):

$$\begin{aligned}
 R_K &= \frac{h}{e^2} = \frac{m_p}{q_p} \lambda_{c,e}^2 = \frac{SP(A)[2d - space]_{m_p} [2d - space]_{electron}}{SP(A)^2 [4d - space]_{q_p}} = \\
 &= \frac{1}{SP(A)} = SP(A) = f = 25813 [s^{-1} = \Omega] \quad (152)
 \end{aligned}$$

Equation (152) is an application of the universal equation as a rule of three. This constant is used as a method of definition and measurement of the SI unit, “ohm“. In fact, von Klitzing constant is a hidden definition and an adequate method of measurement of the basic SI unit, *second*. This becomes evident when we express this constant in terms of time:

$$R_K = \frac{h}{e^2} = \frac{m_p \lambda_A^2}{q_p^2} \times \frac{f_p}{f_{c,e}^2} = SP(A) \frac{f_p}{f_{c,e}^2} = SP(A) f = f \quad (152a)$$

Formula (152a) is a mathematical iteration of the universal equation as a rule of three. Here, the time of the basic photon  $f_p$  has been chosen as the reference periodicity, to which the intrinsic time (periodicity) of the electron, the Compton frequency, is set in relation (principle of circular argument). Such formulae do not enlarge our cognitive knowledge, but merely illustrate the infinite potential of mathematics in creating new physical quantities and relationships - space-time is an infinite continuum.

The Hall effect is an introduction to the classical theory of electromagnetism as embodied in several derivations of the Universal Law for this level of space-time. At present, these derivations are presented as distinct laws. They are of historical importance as precursors of Maxwell’s four equations. For the sake of completeness, these laws will be the topic of the next chapter.

## 6.12 PRECURSORS OF MAXWELL'S EQUATIONS - ELECTROMAGNETISM OF MATTER

The precursors of Maxwell's equations are: 1) **Biot-Savart law** 2) **Ampère's law** 3) **Stokes' integral theorem of Ampère's law** 4) **Gauss's law of magnetism** 4) **Faraday's law**. These laws are applications of the universal equation - they are obtained by introducing new quantities of electromagnetism and building various relationships between them. For this reason, they can be unified in the four Maxwell's equations of electromagnetism. This is a fundamental proof that the diversity of physical laws, which we encounter in present-day physics, is a product of the creative potential of mathematical consciousness and not a real, intrinsic property of the physical world.

**Biot-Savart law** was deduced by Ampère from Coulomb's law for the electric field of a static point charge  $q = SP(A)[2d\text{-space}]$  by replacing it with the *current element*:  $Idl = [2d\text{-space-time}]$  (see chapter 6.2, definition of Ampère). When we replace the product  $qv$  with the current segment  $Idl$  in the equation of the magnetic field,  $B=F/qv$  (143):  $qv = SP(A)[1d\text{-space-time}] = p_{el} = Idl = [2d\text{-space-time}] = LRC_{el} = [n\text{-}d\text{-space-time}]$ , and express the *force* by Coulomb's law, we obtain **Biot-Savart-law** for the magnetic field:

$$dB = \frac{\mu_0}{4\pi} \frac{Idl \times r}{r^2} = f \quad (153),$$

where  $r$  is a unit vector. The method of definition of this law is geometry<sup>185</sup>. Biot-Savart law has many different applications. For instance, it can be applied to a current loop described within Euclidean space as circle, solenoid or straight wire. The actual geometry of the macroscopic electric systems can vary infinitely.

In chapter 6.5 we have learned that Gauss's law is a derivation of Coulomb's law by introducing the quantity *electric flux*, which allows the quantitative description of the electric field on a closed surface related to the net charge (area) within the surface by using electric-field lines (geometric approach). Analogously, **Ampère's law** has been derived for the *magnetic field* by assessing the tangential component of  $B$  summed around a closed curve  $C$  (usually the circumference of a circle) to the current  $I_c$ , which passes through the curve (area of the circle):

$$\oint_C B \cdot dl = \mu_0 I_c = SP(A)[1d\text{-space-time}] = p \quad (154)$$

<sup>185</sup> For a detailed derivation, see PA Tipler, chapter 25-2, p. 815.

Ampère's law is an application of the axiom of conservation of action potentials by using the quantity *momentum*. This law assesses the vertical energy exchange between the magnetic photon system:  $\oint_C \mathbf{B} / \mu_o = \mathbf{B}l_{\mu_o} = SP(A)[1d\text{-space-time}]_m$  (see equation (110),  $SP(A)$  stands for integration) and the material electric current-system  $I_C / dl = SP(A)[1d\text{-space-time}]$  in terms of energy conservation. Ampère's law iterates the law of conservation of momentum of classical mechanics for electromagnetism. In equation (154), the tangential component of the magnetic field corresponds to the *angular frequency* (see equation (154a)). This shows that electromagnetism is a synonym for the vertical energy exchange between magnetic photon level and the electric level of matter. This law is used to describe a collection of electric systems of various geometry. The most common one is the **toroid**:

$$\oint \mathbf{B} \cdot d\mathbf{l} = 2\pi r B = 2\pi r f = \omega = \text{angular velocity} \quad (154a)$$

This formula is an application of the universal equation for the space-time of rotations (see equation (17) in chapter 3.4). It confirms that the magnetic field in Ampère's law is angular frequency.

The application of Ampère's law has been found to be limited. The reason for this is the geometric method of definition of this law - it departs from the geometry of an ideal circle. In reality, it can be observed that the magnetic field  $B$  is not tangent to the curve  $C$  at every point and is therefore not always constant, that is, it is subjected to relativistic changes. This is an aspect of the open character of all systems of space-time (see also the mechanism of gravitation in chapter 4.8). For this reason, Ampère's law has been found to be cumbersome for practical use. Maxwell solved this problem by introducing a new quantity - the **displacement current** (see next chapter).

Within mathematical formalism, one can express the magnetic field by *gradient building* (chapter 6.6). Demonstrating the infinite propensity of mathematical consciousness to create new symbols, *Stokes* introduced a novel symbol, called "rotation" instead of the Nabla-operator:  $\nabla B = \text{rot } B = f/[1d\text{-space}] = Bn$ , where  $n$  is defined as a *vector*  $n = n/[1d\text{-space}]$  ( $n = 1$  is a unit vector) that is perpendicular to the area  $A$  of any electric system, for instance, of a loop. The term "rotation" illustrates that *Stokes* must have intuitively felt that  $B$  is defined as an angular frequency, and that his **integral theorem of Ampère's law** describes a simple rotation. This new presentation of *Ampère's law* is set equivalent to the **magnetic flux**  $\phi_m$  in an analogy with Gauss's law (119):

$$\phi_m = \oint_C \mathbf{B} \cdot d\mathbf{l} = \int_S \mathbf{B} \cdot n dA = SP(A)[1d\text{-space-time}] = p \quad (155)$$

**Stokes' integral theorem** is an iteration of known mathematical patterns - of Gauss's law of the electric flux (equation (119)) and of Ampère's law (equation (154)) - that is continued in Faraday's law and Gauss's law of magnetism. Strictly speaking, the magnetic flux in equation (155) has the dimensionality of a momentum. However, when the vector is regarded as a pure number:  $n = n[1d\text{-space}] = [1d\text{-space}]_{\text{normal}}/[1d\text{-space}] = SP(A)$ , the magnetic flux acquires the dimensionality of an action potential (see Gauss's law of magnetism below):

$$\phi_m = E_A = SP(A)[2d\text{-space}]f \quad (155a)$$

The three laws presented above have been designed to describe the vertical energy exchange from the electric level of matter to the magnetic photon level. In the early 1830s, *M. Faraday* and *J. Henry* discovered independently that a magnetic field can also induce an electric current in a wire, but only when it is changing. This coincidental experimental experience confirms our axiomatic conclusion that any energy exchange occurs in both directions, as all systems or levels of space-time are interacting U-sets, where **change = motion** is the universal manifestation of energy exchange. This is another compelling evidence for the priority of our axiomatic approach over empiricism, which is a tautology of the Universal Law.

Changing magnetic fields produce **induced emfs** (electromotive forces), also called **induced potentials** (induced LRC), and **induced currents** (induced  $E_A$ ) depending on the abstract quantity considered. The vertical energy exchange from the magnetic photon level to the electric level of matter is defined as **magnetic induction**. This approach has led to the derivation of **Gauss's law of magnetism** from Stokes' integral theorem (equations (155) & (155a)):

$$\phi_m = BA = SP(A)[2d\text{-space}]f \quad (156)$$

In this law, **magnetic flux** is defined as the action potential of the magnetic photon system that is transformed into the action potential of the electric system of matter, conventionally called "*induced current*" (axiom of conservation of action potentials). This vertical interaction can also be described in terms of the reciprocal behaviour of the LRC of contiguous levels. In the traditional theory of electromagnetism, this vertical energy exchange is assessed by **Faraday's law**, which is an application of the axiom of conservation of action potentials for the LRC<sup>186</sup>:

---

<sup>186</sup> As already said on many occasions, the axiom of conservation of action potentials is equivalent to the axiom on the reciprocal behaviour of the LRC of contiguous levels. Both axioms interpret the reciprocity of space and time.

$$\mathcal{E} = U = LRC = \int_C \mathbf{E} \cdot d\mathbf{l} = -\frac{d\phi_m}{dt} = LRC_{el} = -LRC_m \quad (157)$$

Equation (157) assesses the reciprocal behaviour of the LRC of contiguous levels. The method of presentation is the continuum of negative numbers as a mirror image of the continuum of real, positive numbers:  $LRC_{el} = -LRC_m$ . This aspect has been already discussed in conjunction with the *Hall effect* (chapter 6.11). The integral calculus used for the electric long-range correlation  $LRC_{el} = \int_C \mathbf{E} \cdot d\mathbf{l}$  and the differential calculus used for the magnetic long-range correlation  $LRC_m = d\phi_m/dt$  implicate a measurement, so that equation (157) actually defines the space-time of the two levels - the magnetic photon level and the electric level of matter. Thus Faraday's law simply says that energy (space-time) is conserved, while exchanged. Indeed, physics can be an open book when appropriately interpreted.

The precursor's of Maxwell's equations shed light on the **magnetism of matter**. Until now we have been speaking of magnetism as a property of photon space-time - of the magnetic field  $B$  as the time and of the magnetic flux  $\phi_m$  as the action potential of the magnetic photon level. In reality, all systems and levels of space-time are U-sets that contain themselves as an element. It is not possible to distinguish the magnetism of photon space-time from that of matter. This is a recurrent motif of the present volume. The concept of "magnetism in matter" is a convenient way of describing some material microscopic levels in terms of electromagnetism. In this sense, one speaks of **magnetization M** of materials, which is defined as the net magnetic dipole moment per unit volume of the material:  $M = dm/dV$ .

Before we interpret this term, we must explain the basic quantity of magnetism - the **magnetic moment**. This quantity is usually defined for the microscopic level. It is an application of rotational mechanics to the atoms or particles of matter (chapter 3.4) which are regarded as rotating systems. The **magnetic moment** of the atoms is defined as the product of the current and the area of the circle:

$$m = IA = I\pi r^2 \quad (158)$$

There is no consistent epistemological explanation for this decision in the theory of magnetism. We shall now give one in the light of the new axiomatics. According to the method of definition and measurement of the electric current and its SI unit *ampere* (see chapter 6.2), the magnetic moment is an arbitrarily selected constant amount of electric energy, to which the electric energy of other electric systems are compared:  $E/E_A = E/I = E/1(\text{ampere}) = f = SP(A)$ . Within mathematics, we are allowed to express the symbol of the electric current with  $SP(A) = n$  without affecting its physical appropriateness.

When we set this symbol in equation (158), we obtain for the **magnetic moment** the dimensionality of  $K_s$ :

$$m = IA = SP(A)[2d\text{-space}] = K_s = \text{moment of inertia} \quad (159)$$

As we are dealing with rotations, the magnetic moment expressed as  $K_s$  is equivalent to the quantity *moment of inertia*  $I$  (see equation (22)), which should not be confused with the current (ambiguity of symbolism). This is a classical example of the dualistic approach in physics. Thus the actual definition of the magnetic moment which is vested behind the conventional derivation of this quantity is that of structural complexity, called the “moment of inertia“ of rotations. This can be illustrated when we scrutinize the conventional method by which this quantity is derived:  $I = qf = q/T = SP(A)[2d\text{-space}]$  and  $T=2\pi r/v$ , so that  $I = qv/2\pi r$ . When  $I$  is substituted in equation (158)  $M = IA$  and the latter is rearranged, we obtain for the **magnetic moment** the above result (equation (159)):

$$\begin{aligned} m &= \frac{q}{2m_q} L = \frac{SP(A)[2d\text{-space}]}{2SP(A)[2d\text{-space}]} E_A = SP(A)E_A = SP(A)[2d\text{-space}]f = \\ &= SP(A)[2d\text{-space}] = K_s, \text{ when } f=1 \end{aligned} \quad (160)$$

Equation (160) shows that the magnetic moment can be expressed in a dualistic manner: dynamically, as action potential with respect to angular momentum  $L$  (24) and statically, as moment of inertia (22) with respect to the area of the circle. Thus the method of definition of the magnetic moment is simple geometry as with most other quantities of physics. In terms of knowledge, this method is fairly simple: the charged particle, e.g. an atom, is regarded as a mass point  $m_q$  without space (volume) that rotates in empty space around an orbit with the radius  $r$ . The same approach was also applied by Bohr in his model of energy quantization of the hydrogen atom (chapter 7.1). The inadequacy of this formalistic view (introduction of an N-set) is a leitmotif of this book.

When we use equation (160) for the electron as the basic action potential of the electron level and set this quantity in relation to the basic photon (action potential) of the photon level, we obtain for the **magnetic moment** of the **electron** the following solution:

$$m = \frac{e\hbar}{2m_e} \frac{L}{\hbar} = \frac{q_p \lambda_A^2}{4\pi} \frac{L}{\hbar} = m_B \frac{L}{\hbar} = \frac{\text{circumference}^2}{4\pi} \times \frac{L}{\hbar} = \text{circle-area} \times \frac{L}{\hbar}$$

$$(161)$$

When the definition of the magnetic moment is applied to the electron, we derive the basic natural constant, called **Bohr magneton** (100), within geometry:

$$m = m_B = K_s \frac{E_{A(L)}}{E_{A(h)}} = SP(A)[2d - space]SP(A) = SP(A)[2d - space] = K_s \quad (162)$$

Knowing the dimensionality of the magnetic moment, we can now answer our initial question concerning the meaning of the term “**magnetization**” (see also equation (47)):

$$M = \frac{dm}{dV} = \frac{SP(A)[2d - space]}{[3d - space]} = \frac{SP(A)}{[1d - space]} = \rho_m = \quad (163)$$

= *magnetic density*

This is the whole theoretical background of the magnetism of matter. This will be substantiated by the following exercises.

*Exercises:*

1. Express the applications of *Biot-Savart law* for a *current loop*, *solenoid* and *straight wire* in the new space-time symbolism and discuss their geometric method of presentation.
2. Derive the SI unit *weber* (Wb) of the magnetic flux from the basic SI units, meter and second.
3. Interpret **Lenz’s law** saying that “the induced *emf* and induced current are in such a direction as to *oppose* the change that produces them“ with the axiom on the reciprocal behaviour of the LRC of contiguous levels. Use the definition of *motional emf*: “any *emf* induced by the relative motion of a magnetic field and a current is *motional emf*“, to discuss why motion is the unique universal manifestation of energy exchange.
4. Describe *eddy currents*, *generators* and *motors* in the light of the Universal Law.
5. Express the equations of *self-inductance* and *mutual inductance* in the new space-time symbolism. Derive the SI unit of inductance *henry* (*H*) from the basic SI units, meter and second.
6. Confirm that the various formulae of *magnetic energy* are derivations of the universal equation.

7. Explain the natural phenomenon of *aurora* with the Universal Law.
8. Show that the quantity *magnetic susceptibility* is an absolute coefficient  $K$  (dimensionless number).
9. Discuss the concepts: *paramagnetism*, *ferromagnetism* and *diamagnetism* in the light of the new axiomatics.
10. Present the various *alternating-current circuits* and their quantities in the light of the new axiomatics. Suggest new interactions that will be more effective in terms of energy availability for work than those used at present.

### 6.13 MAXWELL'S EQUATIONS ARE DERIVATIONS OF THE UNIVERSAL LAW

In 1860, *J.C. Maxwell* discovered in a most dramatic moment in the history of physics, which is only comparable to that of the discovery of the Universal Law in 1994, that the laws of electricity and magnetism obtained before him in an experimental manner could be synthesized in a general mathematical presentation consisting of four interrelated equations. These equations contain the two Gauss's laws for the electric (119) and magnetic flux (156), Biot-Savart law (153), Ampère's law (154), Stokes' integral theorem of Ampère's law (155), and Faraday's law (157). These laws are mathematical derivations of the Universal Law for particular quantities of electromagnetism and their relations. The actual achievement of Maxwell was the introduction of a new quantity, called **Maxwell's displacement current** (164), with which he eliminated the limitations of Ampère's law. Thus Maxwell put the tautological invention of new laws in the area of electromagnetism to an end, just as the discovery of the Universal Law eliminates the deep-rooted conviction of physicists that nature needs more than one law to function.

Maxwell's equations relate the *electric field (acceleration)*  $E$  and the *magnetic field (time)*  $B$  of the electromagnetic systems of photon space-time to their corresponding electric systems of matter, which are described in terms of *charge*,  $Q = K_s = \text{area}$ , *current*,  $I = E_A = \text{action potential}$  and *space quantities*, [1d-space]- and [2d-space]-quantities. As already said on many occasions, these quantities are defined in an abstract manner within mathematics and have no real existence. Therefore our subsequent elaboration of Maxwell's electromagnetism in this chapter will essentially deal with mathematical transformations that depart from the universal equation and intuitively reflect the nature of space-time.

The epistemological achievement of Maxwell's equations is to furnish the evidence that the level of electromagnetism is of **wave character** - his equations can be combined to yield a *wave function* (170 & 170a) that is identical to the classical wave function in wave theory (chapter 4.5) and to Schrödinger's wave equation of quantum mechanics (chapter 7.2). Since de Broglie (1924),

the wave character of matter is a well established fact. This was not so evident at the time when Maxwell first developed the modern theory of electromagnetism.

In the new axiomatics, space-time is energy exchange. Its unique, universal manifestation is motion. Due to the closed character of space-time, **all motions are superimposed rotations** - they are open systems of space-time and contain its properties as an element (U-subsets). Any rotation is a source of waves and vice versa - any wave can be regarded as a superimposed rotation. For instance, the earth's rotation around its axis, the sun and the centre of the Milky way builds a complex wave path. All systems and levels of space-time are particular superimposed rotations - their constant space-time can be assessed with the universal equation (chapter 3.4). Waves (rotations) have the intrinsic capacity to create structural complexity with an infinite variety of forms, for instance, as standing waves or solitons. Such forms have a finite lifetime that depends on the conditions of constructive and destructive interference. This is the basic epistemological outlook of the new axiomatics in terms of wave theory. It can be regarded as a further development of de Broglie's wave-particle dualism. It affects a great simplification in our physical view of the world and, in particular, of electromagnetism and quantum mechanics.

When Maxwell developed his equations through pure mathematical deduction, it was not known that electromagnetism was of wave character. Only 27 years later, did *H. Hertz* confirmed it experimentally. This historical glimpse illustrates the priority of deductive knowledge over empiricism and rejects the latter as an epistemological approach. Hertz' result was, however, anticipated by another basic equation of electromagnetism, which was deduced by Maxwell from the primary term of our consciousness in an intuitive manner - the **speed of light** (see equation (105) and chapter 6.3):

$$c^2 = \frac{1}{\mu_o \epsilon_o} = LRC = E_o l_{\mu_o} = [1d - space] f [space] = [2d - space - time]_p$$

This equation reveals that the speed of light, respectively, the LRC (universal potential  $U_{ij}$ ) of photon space-time can be expressed as a product of its *electric field* or *acceleration*  $E_o$  (109) and its *magnetic field length*  $l_{\mu_o}$  (110):

$$c^2 = E_o l_{\mu_o} = 0.11294 \times 10^{12} [ms^{-2}] \times 0.795775 \times 10^6 [m] = 8.9875 \times 10^{16} [m^2 s^{-2}].$$

$$c = 2.99792458 \times 10^8 [ms^{-1}]$$

The two new abstract quantities of photon space-time,  $E_o$  and  $l_{\mu_o}$ , appear as natural constants in Coulomb's law ( $E_o$ ), Gauss's law ( $E_o$ ), Biot-Savart law

( $l_{\mu_0}$ ) and Ampère's law ( $I_{\mu_0}$ ). As these mathematical laws can be experimentally verified, the two fundamental constants of photon space-time can be easily determined in electromagnetic experiments (empiricism as a tautology of mathematics). Maxwell deduced their values theoretically from the speed of light, the precise magnitude of which had been known in astronomy for a long time.

This example illuminates a key knowledge of the new axiomatics: we only need to know one precise magnitude of space-time to determine any other magnitude by comparing them (principle of circular argument). This can happen through experiments, which are artificially induced interactions of space-time with the objective of measuring (comparing) mathematically defined space-time quantities, or through novel mathematical derivations from known equations (relations) of space-time quantities. These equations contain more information than it is generally believed. The faculty to obtain such new information stems from the new revolutionary knowledge of the nature of space-time as outlined in our axiomatics. I have extensively used the second method to derive many new fundamental constants that enlarge our knowledge of space-time.  $E_0$  and  $l_{\mu_0}$  are such constants. Each of these new constants can be determined in experiments. Thus the new axiomatics of the Universal Law is mathematically **consistent** and empirically **verifiable**. For instance, we shall show in chapter 9.9 that the magnitude of the magnetic field length  $l_{\mu_0}$  is closely related to the space magnitudes of basic gravitational objects, such as neutron stars, white dwarf, black holes etc., which can be roughly estimated in astrophysics today. The same holds for the electric field of photon space-time - it is closely related to the rotational kinetics of these stellar configurations. These constants determine the properties of photon space-time and vice versa (see also volume I). We have proved that the properties of the elementary particles (electrons, protons, neutrons), such as mass, charge, energy, wavelength and frequency, depend on the properties of photon space-time (chapters 3.9, 6.2, 7.1, & 7.4). In this way, the two new fundamental constants,  $E_0$  and  $l_{\mu_0}$ , contribute essentially to the integration of gravitation, electromagnetism and quantum mechanics with cosmology. The departing point of this achievement is the knowledge that space-time has only two dimensions (constituents), space and time, but infinite levels and systems, which are open and render interrelated quantities and magnitudes.

The reason why Maxwell had to introduce the displacement current was the limitation of Ampère's law. This law measures the tangential integral of the magnetic field (angular frequency) around some closed curve  $C$  to the current that passes through any area bounded by that curve:

$$\oint_C \mathbf{B} \cdot d\mathbf{l} = \mu_0 I_C = SP(A) [ld - space - time] = p$$

This geometric approach is based on the notion of closed systems and holds only for non-interrupted currents, that is, for *homogeneous* electric systems of

matter (conservation of momentum). In reality, space-time is inhomogeneous (discrete) and open. When we apply this axiomatic knowledge of the nature of space-time to Ampère's law, we must conclude that its basic statement "the current that passes through any (photon) system bounded by that curve" is a geometric abstraction which neglects the adjacent system that creates the magnetic system or field. For instance, if we have a capacitor that builds a magnetic field, according to Ampère's law there should be no current through the surface of the capacitor's plate because the charge (area) stops on the plate. This notion stems from the idea that electromagnetic waves are propagated in vacuum. In addition, Ampère's law does not consider the recharging of the capacitor.

In the new axiomatics, we define space-time as continuous, but discrete - the open systems and levels are contiguous and exchange energy. Above all, they are U-sets that contain themselves as an element - the space-time of any system is the aggregated product of infinite other levels that can be integrated into two levels (axiom of reducibility). This is precisely the axiomatic conclusion which Maxwell intuitively recognized. He realized that Ampère's law can be presented in a generalized form so as to include all practical situations if the current  $I$  in the above equation is replaced by the sum (aggregated product) of the **conduction current**  $I$  and another component  $I_d$ , called since then **Maxwell's displacement current**:

$$I_d = \varepsilon_o \frac{d\phi_e}{dt} = \frac{d\phi_e}{E_o dt} = \frac{Esf}{E_o} = SP(A)[2d - space]f = E_A \quad (164)$$

This definition incorporates Gauss's law of the electric flux  $\phi_e = E_o A$  with the dimensionality of  $\phi_e = Es = E_A v$  (see chapter 6.5, equations (119, 119a & 119b). The electric field  $E_o$  is a quantity of the magnetic photon system.

Thus the **displacement current** is a definition of the **action potential** of the *magnetic system* that is build around any electric system (current  $I$ ) of matter.

This action potential is regarded from a dynamic point of view and is set in relation to the action potential of the electric system of matter - to the electric current  $I$ . This is the actual advantage of Maxwell's approach over that of classical electricity and magnetism. It is an intuitive application of the axiom of reducibility: the space-time of the resultant electromagnetic system (U-set) is the product of the two interacting action potentials. When the axiom of conservation of action potentials is applied, the resultant action potential of the system can be presented as the sum of the two action potentials within mathematics (degree of mathematical freedom):  $I_{sum} = I + I_d$ . Maxwell sets this new quantity in **Ampère's law** and solves it for the **momentum**:

$$\oint_C B dl = \mu_o (I + I_v) = \mu_o I + \mu_o \epsilon_o \frac{d\phi_e}{dt} = \frac{I_{sum}}{l_{\mu_o}} =$$

$$= SP(A) [1d - space - time] = p \quad (165)$$

The final result of this law remains the same. The new presentation of Ampère's law has the advantage that it involves the two interacting actions potentials. If we now consider that all systems are open U-sets that interact, we must include all action potentials to obtain the exact equation of space-time. This circumstance is known in electromagnetism as the **principle of superposition**. It explains why Maxwell's equations result in complex mathematical calculations when applied to the real world. Mathematics is the only adequate perception of space-time, but only within the limits of the approximation which it introduces through its symbols - the closed real numbers. This is a basic knowledge, which the reader should always keep in mind, while reading the present book.

As with all other laws, Maxwell's new derivation of Ampère's law is also based on the paradigm of "area in motion". This can be easily demonstrated. The sum of the two currents corresponds to the net current that flows in the space of the electromagnetic (photon and electric) system. This results in an increase of the area (charge) within the volume of this system  $I_{sum} = dQ/dt$ . This is the classical definition of electric current (chapter 6.9). This "area (charge) in motion" can be set in relation to the electric flux:  $\phi_e = Q/\epsilon_o = EQ$  (119b). When this equation is divided by  $dt$ , we obtain the **displacement current**:

$$\epsilon_o \frac{d\phi_e}{dt} = \frac{d\phi_e}{Edt} = \frac{dQ}{dt} = I_d = E_A \quad (166)$$

Evidently, the above formulae are mathematical iterations of the universal equation:  $E=E_A$ , when  $f=1$ . When the time  $f$  is considered, **Faradays's law** can be presented in a new mode with respect to Maxwell's displacement current:

$$\mathcal{E} = \oint_C E dl = - \frac{d\phi_m}{dt} = SP(A) [2d - space - time] = E_A f \quad (167)$$

The symbol SP(A) stands for integration. The minus sign assesses intuitively the reciprocal character of the LRC of contiguous levels. The above derivations illuminate how the precursors of Maxwell's equations have been unified into the **general equation of electromagnetism**, which is a derivation of the

universal equation. Within mathematics, it is traditionally presented by the following **four Maxwell's equations**:

$$\oint_S \mathbf{E}_n dA = \frac{1}{\epsilon_o} Q_{innen} = \mathbf{E}_o Q_{innen} = E_S = E_A \vee \quad (168a)$$

$$\oint_S \mathbf{B}_n dA = SP(A) f[2d - space] = E_A = 0 \quad (168b)$$

$$\oint_C \mathbf{E} dl = - \frac{d}{dt} \int_S \mathbf{B}_n dA = E_A \neq 0 \quad (168c)$$

$$\oint_C \mathbf{B} dl = \mu_o I + \mu_o \epsilon_o \frac{d}{dt} \int_S \mathbf{E}_n dA = p = SP(A)[1d-space-time] \quad (168d)$$

The above equations represent the **integral form** of the Universal Law. Equation (168a) stands for Gauss's law of electric flux and expresses the universal equation  $E=E_A f$  in the mathematical form:  $E_S = E_A \vee$  (see point 25, (25-1)). Equation (169b) stands for Gauss's law of magnetism and Stokes' integral theorem of Ampère's law and tells us that any action potential can be unilaterally regarded as the "improbable event",  $E_A = SP(A) = 0$  when it is completely transformed into another action potential (axiom of conservation of action potentials). Equation (168c) stands for Faraday's law and expresses the axiom of conservation of action potentials bilaterally:  $E_{A1} = (-)E_{A2} = SP(A) \geq 0$ . Finally, equation (168d) assesses the electromagnetic system resulting from the vertical energy interaction between the electric system of matter and the magnetic system of photon space-time as a momentum, which is presented as a vector (line) - hence the concept of electric and magnetic field-lines. This is a frequent geometric paradigm inherited from classical mechanics that has led to the two-dimensional presentation of space-time in physics. We conclude:

The **four Maxwell's equations** are mathematical derivations of the Universal Law obtained by the axiom of reducibility - they assess the vertical energy exchange between the *photon level* presented as a changing *electromagnetic field* ( $\mathbf{E}$  and  $\mathbf{B}$ ) and the *electric level* of matter (predominantly the electron level) given as a *current*  $I(E_A)$ .

The above four integral equations can also be expressed in the **differential form** without affecting the final results. This is done by using the Nabla-operator:  $\nabla a = da_{x,y,z}/dx,y,z = a[1d-Raum]$  (chapter 6.6):

$$\nabla E = 0 = SP(A) \frac{[1d - space - time]f}{[1d - space]} = SP(A)f^2 = f^2 = 0 \quad (169a)$$

$$\nabla B = 0 = SP(A) \frac{f}{[1d - space]} = 0, \text{ as } f \rightarrow 0 \quad (169b)$$

$$\nabla E = -\frac{dB}{dt} = SP(A)f^2 = f^2 = SP(A) = 1 \quad (169c)$$

$$\nabla B = +\mu_o \varepsilon_o \frac{dE}{dt} = SP(A) \frac{f}{[1d - space]} = SP(A) = 1,$$

$$\text{when } f = SP(A) = 1 \text{ and } [1d - space] = SP(A) = 1 \quad (169d)$$

The above equations are said to hold in vacuum (empty space). In fact, they hold in **photon space-time**. They are mathematical iterations of Kolmogoroff's probability set, which is an equivalent concept of the primary term. We conclude:

The **four Maxwell's equations** express in their **differential form** the **probability set**  $0 \leq SP(A) \leq 1$ , which is a formalistic mathematical perception of the primary term (see point 37.)

The last two equations, (196c) and (196d), acquire in the conventional differential presentation the following form:

$$\frac{\partial^2 E}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 E}{\partial t^2} \quad (170)$$

$$\frac{\partial^2 B}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 B}{\partial t^2} \quad (170a)$$

Thus the two Maxwell's equations appear to be derivations of the wave equation (chapter 4.5, equations (58) and (58a)) for a **plane** (area) electromagnetic wave. However, this does not mean that the electromagnetic waves are really plane, but that the geometric approach departing from the  $LRC = c^2$  of photon space-time automatically results in a  $[2d - space]$ -presentation of the

electromagnetic level of photon space-time. Within geometric formalism, the electric field and the magnetic field are regarded as superimposed waves that oscillate in phase with the same frequency. When equations (170) and (170a) are rearranged, we obtain a simple relation:

$$E = Bc = [1d\text{-space-time}]f = \text{acceleration} = a \quad (171)$$

The electric field  $E$  around an electric system of matter is  $B = f$  times greater than the one-dimensional space-time of the photon level. As both the electric field and the magnetic field are presented as perpendicular vectors, the direction of propagation of the resultant electromagnetic wave (U-set) is the direction of the cross product  $E \times B$  (geometry of photon space-time). However, we should be aware of the fact that geometry is a posterior method of presenting space-time and does not enlarge our knowledge of the primary term, that is, of the physical world. Any true knowledge can only be acquired in philosophical and logical categories. Mathematics, being a symbolic prolongation of logic, is a secondary categorical system for the precise presentation of space-time.

#### 6.14 THE WAVE EQUATION IS THE DIFFERENTIAL FORM OF THE UNIVERSAL EQUATION

In the previous chapter we have shown that the two Maxwell's equations, (170) and (170a), are applications of the classical wave equation (61) for photon space-time by setting the square speed of light as the LRC of this level:  $LRC = U_U = c^2 = v^2 = [2d\text{-space-time}]$ . From this we come to the following important conclusion:

The **wave equation** is the **differential form** of the universal equation:

$$E = LRC = \frac{\partial x^2}{\partial t^2} = \partial x^2 \partial f^2 =$$

$$= SP(A)[2d\text{-space-time}] = [2d\text{-space-time}], \text{ when } SP(A) = 1 \quad (172)$$

It can be applied to any level of space-time, such as material levels (optics, acoustics), electromagnetic level of photon space-time (electromagnetism) and microscopic particle levels (Schrödinger wave equation of quantum mechanics).

The method of definition of various physical quantities that are presented as [2d-space-time]-quantities is differential calculus as employed in Nabla- and Laplace-operators (chapter 6.6). Due to the frequent two-dimensional presentation of the primary term within mathematical formalism according to the axiom of reducibility, one can obtain the 1st and 2nd derivative of this quantity with respect to time or space. In chapter 7.2 we shall show that this is the method of definition of Schrödinger wave equation. Here, we shall present some frequent quantities of electromagnetism that are obtained from the primary term by the method of differential calculus.

The **energy density**  $\eta_e$  of the electromagnetic wave is a common quantity that is obtained by gradient-building from the electromagnetic energy:

$$\begin{aligned}\eta_e &= \nabla E = \nabla hf = \nabla LRC = [2d\text{-space-time}] / [1d\text{-space}] = \\ &= [1d\text{-space-time}] f = E, a\end{aligned}\quad (173)$$

The energy density has the dimensionality of the electric field (acceleration) and is thus not identical with the classical density (equation (47)). This example illustrates the confusion which one finds in physics - the quantities are introduced in a chaotic manner within mathematics without making any effort to organize them in an axiomatic system. This is the major deficiency of this discipline, as can be proven by further expressions of the *energy density*, which do not reveal the differential method at first glance:

$$\eta_e = E, a = \frac{1}{2} \epsilon_o E^2 = \frac{E^2}{2E_o} = [1d\text{-space-time}] f \quad (174)$$

This equation (rule of three) is often used in quantum mechanics. It is also applied to obtain the **magnetic density** in a tautological manner:

$$\eta_m = E, a = \frac{B^2}{2\mu_o} = \frac{(E/c)^2}{2\mu_o} = \frac{E^2 l_{\mu_o}}{2c^2} = \frac{E^2}{2E_o} = [1d\text{-space-time}] f \quad (175)$$

From equations (174) and (175), the **electric** and **magnetic density** of the electromagnetic waves (photons) are obtained as U-sets:

$$\eta_e + \eta_m = \epsilon_o E^2 = \frac{E^2}{E_o} = \frac{B^2}{\mu_o} = B^2 l_{\mu_o} = \frac{EB}{\mu_o c} = \frac{EB l_{\mu_o}}{\lambda_A} \quad (176)$$

The above equations illustrate the redundant, pleonastic character of physical mathematics. This also holds for the quantity “**Poynting-vector**“:

$$S = \frac{\mathbf{E} \times \mathbf{B}}{\mu_0} = \mathbf{E} \times \mathbf{B} \cdot I_{\mu_0} =$$

$$= [2d\text{-space-time}]f = Ef = E_A f = E, \text{ when } E = E_A \text{ and } SP(A) = 1 \quad (177)$$

These exercises can be continued *ad infinitum* - mathematics, being an adequate perception of space-time, has an infinite capacity of producing new terms, just as space-time has an infinite capacity of creating new levels of space-time. This same tendency of space-time is also manifested by human consciousness, which is a mirror image of space-time.

*Exercises:*

1. Present the *average density*  $I$  and the *radiation pressure*  $P_r$  of electromagnetic waves in the new space-time symbolism. Discuss the *electromagnetic spectrum* in the light of the new axiomatics.
2. Prove that *Michelson interferometer* assesses the Universal Law, for instance, in two-slit interference pattern, diffraction gratings, interference-diffraction pattern of two slits, *Fraunhofer* and *Fresnel diffraction* etc.
3. Explain the **hologram** from the primary term (U-sets). Use the hologram as a model to explain the development of spatial perceptions in the cortex. Suggest new applications of the Universal Law in the development of mind-controlled electronic devices.

## 7. QUANTUM MECHANICS

### 7.1 BOHR MODEL OF ENERGY QUANTIZATION ANTICIPATES THE INHOMOGENEITY OF SPACE-TIME (ND)

The history of physics is a circular motion of recurrent events. As physics moved into the twentieth century, just a few physical phenomena appeared unexplained. We observe the same conviction among physicists at the end of the second millennium. Today, it is generally believed that all laws of physics have been already discovered, so that there is no urgent need to unify them to a single Universal Law of nature or explain them in terms of knowledge. Just as the few discrepancies in the theory of classical mechanics and electromagnetism have sufficed to topple the whole edifice of nineteenth century physics, so did the rest of these discrepancies which have neither been corrected by the theory of relativity nor by the theory of quantum mechanics - they have led to the irrevocable abolishment of present-day physics consisting of numerous semantic and mathematical tautologies and inconsistencies. It has been replaced by a new, self-consistent and straightforward physical and mathematical axiomatics based on a single term.

While the **special theory of relativity** (see section 8.) was established by *Einstein* in a single stroke around 1905, the foundations of **quantum mechanics** were gradually laid by him (explanation of the photoelectric effect) and by many other physicists between 1905 and 1926 (e.g. *Schrödinger*, *Heisenberg*). It is remarkable that the origins of quantum mechanics were not in the discoveries of radioactivity or atomic spectra, but in thermodynamics, or more precisely, in the interpretation of the laws of radiation which assess the vertical energy exchange between the thermodynamic level of matter and photon space-time (see chapter 5.5 and Stankov's law in chapter 5.7).

Based on the concept of blackbody radiation as employed in Stefan-Boltzmann's law (equations (80) & (80a)), the historical **Rayleigh-Jeans law** was derived in a classical calculation of thermodynamics describing the *homogeneous* distribution of the power of radiation with respect to the wavelength as assessed by *Wien's displacement law*:  $P(\lambda, T) = 8\pi k T \lambda^{-4}$ . When this law was applied to short wavelengths, it rendered infinite amounts of radiated photon energy, called the **ultraviolet catastrophe**.

In 1900, *Planck* acquired through pure deduction a novel presentation of this law by assuming a **finite, constant quantity of photon energy** - the **Planck's constant  $h$**  - and thus eliminated the ultraviolet catastrophe as a mathematical artefact. In the new axiomatics, we call this elementary constant amount of energy the **basic photon** or the **basic action potential** of the photon level. It is the universal reference system to which all space, time and spa-

ce-time relationships, e.g. as mass, are compared as physical quantities according to the principle of circular argument by introducing the SI system. Planck's equation  $E=hf$  gave birth to the idea that **space-time is quantized**, that is, **discrete** or **inhomogeneous** (see point 5.). This philosophical concept builds the foundation of quantum mechanics, including Bohr model, Schrödinger's wave equation, QED, QCD and GUT. **Planck's famous equation of photon energy:**

$$E = hf = E_A f = m_p c^2 = SP(A)[2d\text{-space-time}] \quad (178)$$

is an application of the Universal Law for the photon level. Using this equation, Einstein explained the **photoelectric effect**, for which he was awarded the Nobel Prize. He departed from the vertical energy exchange between the electron level of matter and the photon level, which was experimentally found to be quantized (*Hertz*, 1887; *Lenard*, 1900). When the intensity of light of a given frequency is increased, more photons fall on the surface per unit time, but the energy absorbed by each electron is unchanged. If  $\phi$  (should not be confused with the magnetic flux) is the energy necessary to remove an electron from a metal surface, the **maximum kinetic energy** of the electron is given by **Einstein's photoelectric equation:**

$$(1/2mv^2)_{\max} = eV_o = hf - \phi = dE = SP(A)[2d\text{-space-time}] \quad (179),$$

where  $V_o$  is called "stopping potential" and  $\phi$  - "work function". Equation (179) presents the two levels which participate in this vertical energy exchange as open entities. It also determines the borderline conditions, under which electrons are ejected and build a distinct level of kinetic electrons. These conditions are assessed by the magnitudes of the two constituents of photon space-time - **threshold frequency  $f_t$**  and **threshold wavelength  $\lambda_t$** :

$$\phi = hf_t = \frac{hc}{\lambda_t} = E_A f_t = E_A \frac{v}{\lambda_t} = SP(A)[2d\text{-space-time}] \quad (179a)$$

The photoelectric effect was further supported by the discovery of **x-rays** by *Röntgen*, the first recipient of the Nobel Prize for physics in 1901. When electrons interact with a material system, they produce a specific **Bremsstrahlung spectrum** (braking radiation). Its **cutoff wavelength  $\lambda_m$**  is assessed by a derivation of equation (179a):

$$\lambda_m = \frac{hc}{E} = \frac{hc}{eV} = [1d\text{-space}] \quad (179b)$$

Further evidence for the vertical energy exchange between the electron level and the photon level was furnished by *Compton* in a key experiment, measuring the scattering of x-rays by free electrons. In chapter 3.9 we have departed from the axiom of conservation of action potentials and expressed the classical equation of **Compton scattering** in the new space-time symbolism. From this experiment we have determined the *mass of the basic photon*  $m_p = 0.737 \times 10^{-50} \text{ kg}$  (equation 45b), which is a novel fundamental constant obtained for the first time in conjunction with the discovery of the Universal Law (see also Table 1).

These scattered experimental data called for a general model that could explain the various quantum effects. In 1913, *Bohr* proposed a **model of energy quantization** for the **hydrogen atom** that had a spectacular success in calculating the wavelengths of the lines of known hydrogen spectrums (*Balmer*, *Lyman* and *Paschen series*) and in predicting new lines. This model had a precursor - the **Rydberg-Ritz formula**, which gives the *reciprocal wavelength* of radiation spectrums as:

$$\frac{1}{\lambda} = RZ^2 \left( \frac{1}{n_2^2} - \frac{1}{n_1^2} \right), \quad n_1 > n_2 \quad (180)$$

This formula is valid not only for hydrogen with the atomic number  $Z = 1$ , but also for heavier atoms of nuclear charge  $Ze$ , from which all electrons, but one, have been removed. The quantity  $R$  is called **Rydberg constant**. We shall show that it has the dimensionality of time  $R = f$  and is thus constant for all series of an element. In quantum mechanics, it is usually given as the reciprocal wavelength:  $R_\infty = f = 1/\lambda = 1/[1d\text{-space}] = 10.97373 \text{ } \mu\text{m}^{-1}$ . This presentation reflects the reciprocity of space and time.

Bohr considered recent works of Planck and Einstein, and, especially, those of Rutherford, with whom he worked at that time, and proposed a mathematical model which he developed by pure deduction (priority of mathematics over empiricism). According to it the negatively charged electrons revolve in a circular or elliptical orbit around the positively charged nucleus, similar to the planet's rotation around the sun. A Coulomb force of attraction is exerted between these opposite charges. It acts on the electron like a centripetal force of gravitation. According to classical electrodynamics, such electrons are bound to lose energy and must collapse in a spiral orbit on the nucleus. Bohr eliminated this theoretical problem by postulating the **quantization of electron energy**. In his **first postulate**, he lets the laws of classical mechanics be valid within discrete energy levels: "In an atom, the electron rotates in stable, non-radiating orbits called **stationary states**." This idea of a closed system is not new, for it goes back to Kepler's laws describing the motion of planets around stable, closed orbits (see chapter 3.5).

The novelty of Bohr's approach is that he departs from Coulomb's law and not from Newton's law of gravity. In chapter 3.7, we have shown that both laws are identical mathematical applications of the Universal Law. In Bohr model, the electron is imagined as a charge point with a zero space that revolves around the nucleus in a circular orbit with the radius  $r$ . The geometric method of definition of this model is cogent.

It is important to observe that at the time when Bohr developed his model almost nothing was known about the composition of the nucleus, except that it was positively charged. In fact, Bohr postulated an equivalence between the electrostatic energy of the electron and its gravitational energy by considering them as U-sets. Mathematically, the model assumes an equivalence between the Coulomb force  $F_{el}$  and the centripetal gravitational force of Newton  $F_g$ , with which the vertical energy exchange between the two systems, electron and nucleus, is assessed:

$$\frac{m_e v^2}{r} = \frac{e^2}{4\pi\epsilon_0 r^2} \rightarrow \frac{m_p f_{c,e} v^2}{r} = \frac{E_o e q_p f_{c,e}}{4\pi r^2} \quad (181)$$

This is an application of the axiom of conservation of action potentials for this vertical energy exchange expressed by the force as an abstract quantity of space-time. The above equation holds for the hydrogen atom with a nucleus of one proton and an electron with the charge (area) of  $+e$ . We can rearrange equation (181) in the following manner:

$$4\pi m_p v^2 r = E_o q_p^2 f_{c,e} \quad (181a)$$

When we solve equation (181a) for the electron velocity  $v$ , which is a tangential velocity, we obtain the **kinetic space-time** of the electron as its LRC:

$$v^2 = \frac{e^2}{4\pi\epsilon_0 m_e r} = \frac{E_o q_p^2 f_{c,e}}{4\pi m_p r} = [2d - space - time] = LRC_{kin} = cons. \quad (182)$$

Equation (182) reveals that the kinetic space-time of the electron depends exclusively on the space-time magnitudes of the basic photon  $h$  given as charge  $q_p$  and mass  $m_p$ , as well as on the electric field of the photon level  $E_o$ . The Compton frequency  $f_{c,e}$  can be regarded as the **intrinsic time**  $f_{in}$  of the electron, which is a specific microscopic system  $f_{c,e}=f_{in}$ . We have shown that this quantity depends on the space-time of the basic photon:  $f_{c,e}=e/q_p=SP(A)$  (98). Just as the intrinsic time of the electron is a function of photon space-time, so also is the second constituent of this microscopic system - the so called **Bohr radius**  $a_o$ . We shall derive this constant below in equation (191).

Throughout this elaboration of the basics of quantum mechanics, a ubiquitous fact emerges that should be noted at this point: all mathematical presentations of quantum systems can only give the space and time magnitudes of the systems as **constants** (constant space-time of the parts). This is a leitmotif of the new axiomatics: as the physical world has only two dimensions, physics can only determine constant space, time, or space-time relationships between systems or levels. This fundamental aspect of physical cognition has been extensively discussed in the previous chapters. For this reason, all parameters and natural constants, which we shall subsequently discuss in quantum mechanics are space, time and space-time magnitudes. This knowledge simplifies significantly the current semantic complexity of quantum mechanics. At present, this discipline is overloaded by many obscure terms, which are not properly understood by physicists from an epistemological point of view.

In his **second postulate**, which is a logical consequence of the first postulate, Bohr rules out the radiation of photons in the stationary states. The atom, or more precisely, the electron, radiates only when this particle makes a transition from one stationary state to another. The frequency of the emitted photons is related to the energy difference of the orbits  $E_1 - E_2$  and is set in comparison to the energy of the basic photon  $h$  (principle of circular argument):

$$f = \frac{E_1 - E_2}{h} = \frac{dE}{h} = \frac{E}{E_A} = SP(A) \quad (183)$$

Equation (183) is an application of the Universal Law for the level of emitted photons. It assesses the vertical energy exchange from the atomic level of matter to the photon level. It can be interpreted in terms of the axiom of conservation of action potentials:  $hf = E_p = \Delta E_o$ . In this case, the energy difference of the electron orbits is set equivalent to the energy of the emitted photons  $E_p = hf$ .

Based on these two postulates, Bohr's objective is to find a general solution of Rydberg-Ritz formula that has been proven to be valid in predicting spectral lines. For this purpose, he sets the kinetic space-time of the electron as given in equation (182) equal to the total energy of the electron (axiom of conservation of action potentials). By rearranging the above equations, he obtains for the **time** of the **emitted photon** the following equation:

$$f = \frac{dE}{h} = \frac{e^2}{8\pi\epsilon_o h} \left( \frac{1}{r_2} - \frac{1}{r_1} \right) = K \left( \frac{1}{r_2} - \frac{1}{r_1} \right) \quad (184)$$

Equation (184) is solved for the hydrogen atom ( $Z = 1$ ). The product in front of the parenthesis is a constant because it constitutes constant quantities. This constant  $K$  can be expressed in many different ways, such as:

$$K = \frac{e^2}{8\pi\epsilon_0 h} = \frac{E_o e^2}{8\pi m_p c^2} = \frac{q_p^2 f_{c,e}^2}{8\pi m_p l_{\mu_0}} = \text{etc.} =$$

$$= v = [1d - \text{space} - \text{time}] = \text{cons.} \quad (184a)$$

As we see, this constant is [1d-space-time]-quantity assessing the constant energy of the emitted photons as velocity during a transition of the electron from one stationary state into another. This transition can be regarded as a horizontal energy exchange within the electron level - our degree of mathematical freedom allows us to describe the two stationary states as distinct systems of the electron level that interact (axiom of reducibility). Similar to the tangential velocity of the electron, the above constant depends only on the space-time magnitudes of the photon level. When this constant is divided by the difference of the radii of the two stationary states, we obtain the time of the emitted photons as a frequency:

$$f = v/dr = [1d-Raumzeit]/[1d-Raum] = f \quad (184b)$$

Equations (184a) and (184b) are iterations of the universal equation as presented in Bohr's second postulate in equation (183). At this point, **Bohr's third postulate** is introduced. It says: "The *angular momentum*  $L$  of the electron revolving in a circular stationary orbit has **discrete** values". Bohr expresses this intuitive perception of the inhomogeneity of space-time mathematically with respect to the basic photon. The method of definition is geometry (see equation (24)):

$$L = mvr = nh/2\pi = E_A \quad (185)$$

This is an application of the universal equation for rotations (chapter 3.4). The number  $n$  is defined by Bohr *a priori* as an **integer** that belongs to the continuum of closed, real numbers (definition by abstraction). Since then, quantum theory has failed to give a proof as to why this number should be an integer. It is introduced in an abstract way and is thus a pure product of the free will of mathematical consciousness. This number embodies the human preference for closed, real numbers over transcendental numbers. The closed real numbers are introduced by the method of definition of physical quantities and only then experimentally confirmed by the same method of measurement, e.g. by SI units (vicious circle). This observation is of eminent importance for

a proper epistemological understanding of quantum physics and its theoretical problems.

Equation (185) reveals that Bohr model is an application of the Universal Law for rotations. In this sense, the electron and all quantum systems are regarded as **superimposed rotations**, whereby each rotation is a source of a wave and vice versa (**wave character** of matter). This is the vested paradigm behind all presentations of quantum physics, such as Schrödinger's wave equation, QED and QCD. This fact has been obscured by the various mathematical methods, such as statistics, differential and integral calculus, exponential calculus, and modern geometric methods, which are simultaneously employed in quantum mechanics. The origin of these mathematical operations is the Universal Law. From a geometric point of view, rotations can be formally described by closed [*1d-space*]-quantities, such as circumferences, or by open [*1d-space*]-quantities, such as straight lines. For instance, the radius of a circular orbit is an open [*1d-space*]-quantity.

If we now interpret Bohr's third postulate of energy quantization of the electron in terms of rotation (185) by resorting to *de Broglie's wave-particle dualism*, we can exchange the linear momentum  $mv$  of the angular momentum  $L = mvr$  with the quotient  $h/\lambda = E_A/\lambda = mv\lambda/\lambda = mv$  (tautology of quantities). In this case, we obtain the following simple relation:

$$n\lambda = 2\pi r = C \quad (185a),$$

where  $C$  is the **circumference** of Bohr stationary orbit of the electron. **De Broglie's interpretation** of Bohr's quantization condition (3rd postulate) is based on the idea that the electron is a **standing circular wave** - its circumference  $C$  gives the stationary orbit of the electron. This is simple geometry applied to the real world and expressed in terms of wave theory (see section 4). Thus Bohr's third postulate can be rewritten as follows:

$$n\lambda/2 = \pi r = C \quad (185b)$$

Equation (185b) describes the **standing wave condition** (equation (58)) for a circular wave as discussed in chapter 4.4. Bohr uses this equation to calculate Bohr radius and Rydberg constant. We shall now analyse the rational method of calculation behind Bohr model in the light of the Universal Law.

Bohr follows the intuitive notion of the reciprocity of space and time and determines the actual magnitudes of the two constituents for the system "electron in an atom" according to the principle of circular argument. The angular momentum of the electron, which was originally regarded as a mass point (zero space), is, in fact, the action potential of this rotational system:  $L = mvr = nh/2\pi = E_A$ . In Bohr's third postulate (185), the **electron's action potential** is given as  $E_A = 2\pi L = SP(A)[2d-space] f$ , whereas  $\pi = SP(A)$ :

$$E_A = 2\pi L = 2\pi mvr = 2\pi mr^2\omega = nh \quad (185c)$$

As already pointed out in chapter 3.4, the two quantities of rotations,  $v$  and  $\omega$ , are defined in physics in an ambiguous manner and can be potentially misinterpreted. The tangential velocity  $v = \omega r$  has the dimensionality of an action potential of rotation  $E_{A,rot}$  (equation (19)). Notwithstanding this fact, the angular velocity, which is [1d-space-time]-quantity (equation (17)), is conventionally presented as a number  $\omega = d\Theta/dt = f$  (angular frequency), because the angle is given in physics as a number. These are basic inconsistencies that obscure the epistemological explanation of the mathematical procedures in quantum physics. Because of these inconsistencies, the tangential velocity is usually presented as [1d-space-time]-quantity:  $v = \omega r = f [1d-space] = [1d-space-time]$ .

This clarification is the key to a proper interpretation of Bohr's third postulate. The product  $mr^2$  in equation (185c) is defined as the *moment of inertia*  $I = mr^2 = K_s = area = SP(A)[2d-space]$  (see equation (22)). In Bohr model, this quantity is conventionally presented as a mass particle with "zero" space that revolves in Bohr stationary orbit. In the new axiomatics, the electron is regarded as a space-time system with a constant real space, which can be described one-dimensionally by its circumference  $C$  within geometry. In Bohr model, the moment of inertia of the electron is regarded as the certain event:  $I = mr^2 = K_s = area = SP(A)[2d-space] = SP(A) = 1$ . In this case, the *intrinsic time* of this system should also be defined as the certain event:  $f_{in} = SP(A) = 1$ . In this sense, the moment of inertia of the electron is the static expression of the **intrinsic action potential**, that is, of the **intrinsic angular momentum**  $L_{in}$  of the electron:

$$m_e r^2 = m_e r^2 f_{in} = SP(A)[2d-Raum] f = L_{in} = E_{A,in} \quad (186)$$

Equation (186) is obtained consistently within the classical mechanics of rotations as expressed in the new space-time symbolism. We can now set for the *intrinsic time* of the electron its Compton frequency, and define this quantity as the **certain event**:

$$f_{in} = f_{c,e} = SP(A) = 1$$

This is the degree of mathematical freedom also used by Bohr. When we set the intrinsic action potential from equation (186) in Bohr's third postulate as given in (185c), we obtain the following result:

$$\begin{aligned} nh &= 2\pi m_e r^2 \omega = 2\pi E_{A,in} \omega = 2\pi L_{in} 2\pi f_{ex} = 4\pi^2 E_{A,in} f_{ex} = \\ &= SP(A)[2d-space-time] = E \end{aligned} \quad (187)$$

In this equation, the electron with its external angular velocity is regarded as a revolving mass point. In Bohr model it is expressed by the **external time**  $f_{ex}$  of this particle, where  $4\pi^2 = SP(A)$ . We conclude:

The equation of **Bohr's third postulate** is a concrete application of the Universal equation  $E = E_A f$  for the electron as a **superimposed rotation**, respectively, as a **circular standing wave**. The electron is regarded as the resultant system of an interaction between the **inner (intrinsic) rotation** and the **external (extrinsic) rotation** of the electron according to the axiom of reducibility:

$$L = nh = E_{A,in} f_{ex}, \text{ when } 4\pi^2 = SP(A) = 1 \quad (187a),$$

Equation (187a) is an application of the axiom of conservation of action potentials. From this, we arrive at the new interpretation of Bohr's third postulate:

As the **basic action potential of the photon level  $h$**  is completely transformed into the **inner action potential** (intrinsic angular momentum) of the electron:

$$E_{A,in} = L_{in} = h \quad (187b),$$

the **external time**  $f_{ex}$  of the electron, which is assessed by the angular frequency of the electron as a revolving mass point, is set in an *a priori* manner equivalent to the **continuum of natural integers  $n$** .

$$f_{ex} = n = \text{continuum of natural integers} \quad (188)$$

Equation (188) demonstrates repeatedly the priority of mathematical consciousness over empiricism - all quantities introduced in physics are *a priori* objects of thought defined within mathematics and only then confirmed in expensive and redundant experimental research. The third Bohr's postulate is thus an application of the principle of last equivalence - *space-time = continuum* - for the electron as a particular system of space-time. It is quite obvious that we might as well build this equivalence with the continuum of transcendental numbers. In fact, we must do this in order to overcome the inherent shortcomings of Bohr model. Unfortunately, we still have no mathematics of transcendental numbers.

When the resultant angular momentum  $L$  of the electron is set in relation to the basic photon (principle of circular argument), the resultant time of this quantum system is conventionally defined as **quantum numbers**:

$$\frac{L}{\hbar} = \sqrt{l(l+1)} = SP(A) = f$$

In this case,  $n = 1, 2, 3, \dots$  is the **primary quantum number**,  $l = 0, 1, 2, \dots, n-1$  is the **quantum number** of the **angular momentum**, and  $m = -l, -l+1, -l+2, \dots, +l$  is the **magnetic quantum number**. These mathematical pleonasms of the time magnitudes of the electron level(s) in the atom (atomic level) play a key role in the traditional microscopic view of quantum mechanics. In reality, they appear to be subsets of the continuum of closed, real numbers, which is the current equivalent mathematical expression of space-time in physics.

If we now substitute the external time  $f_{ex}$  with  $n$  in the above equations and rearrange them accordingly, we obtain the following relationship between the **external tangential velocity**  $v$  of the electron and the **continuum of integers**  $n$ :

$$v_{ex} = \frac{h}{2\pi m_e r} n = \frac{m_p \lambda_A^2}{2\pi m_p f_{c,e} r} n = \frac{\lambda_A^2}{2\pi f_{c,e} r} n \quad (189)$$

In any given stationary orbit with the radius  $r$ , the one-dimensional space-time of the electron depends only on the continuum of integers  $v_{ex} \approx n$  because the quotient in front of  $n$  is a constant. The magnitude of this constant is determined by the constant space-time of the basic photon. In fact, equation (189) is an application of the universal equation as a rule of three:  $v = (\lambda_A^2 / 2\pi r) \times (f_{ex} / f_{c,e})$ . It simply compares the space ( $r$ ) and time ( $f_{ex}, f_{c,e}$ ) quantities of the electron as the basic action potential of this level with that of the basic photon when its wavelength and frequency are defined as reference units:  $\lambda_A, f_p = 1$ . However, equation (189) has a deeper meaning. We can rewrite the term  $2\pi f_{c,e} r$  to obtain the **intrinsic tangential velocity**  $v_{in}$  of the electron:

$$2\pi f_{c,e} r = \omega r = v_{in} \quad (189a)$$

If we express the basic photon in the numerator of equation (189) with the speed of light  $h = m_p c^2$  (see equation (44)) and rearrange this equation, we obtain the product of the **intrinsic** and **extrinsic tangential velocity** (axiom of reducibility) as a function of the reference speed of light:

$$v_{ex} v_{in} = c^2 n \quad (189b)$$

Equation (189a) tells us simply that the **aggregated tangential velocity**  $v_a = v_{ex} v_{in}$  of the electron which is regarded as a superimposed rotation is  **$n$  times greater than the square speed of light**:

$$v_a = c^2 n \quad (189c)$$

This is a remarkable result that topples another basic paradigm of traditional physics, or more precisely, of the theory of relativity, which postulates that the speed of light is the maximum speed we can observe in the physical world. How can this “change of paradigms“ be digested by the conventionally thinking physicist? Very easily. The knowledge that all elementary particles, such as the electron, have a bigger aggregated tangential velocity, that is, one-dimensional space-time, than the basic photon is a logical consequence of the reciprocity of space and time, respectively, of energy and space (see point 23, (23-1)):

$$E \approx f \approx 1/[1d\text{-Raum}]$$

The greater the energy (space-time) of a system, the smaller its space (extent). Had this been known earlier, the standard model would not have been developed. It is, indeed, an act of revelation to confirm each time the validity of the new axiomatics of the Universal Law. Its consistency and lack of contradiction reflects the consistency of the real physical world - the existence of one single Law. This consistency is intrinsic to the present physical axiomatics<sup>187</sup>.

Equation (189c) illustrates the reciprocity of space and time. The Compton wavelength is exactly  $f_{c,e}$ -times smaller than the wavelength of the basic photon:  $f_{c,e} = \lambda_A/\lambda_{c,e} = 1.235589 \times 10^{20}$ . Any space-relationship which we obtain for any two systems of space-time, gives us the reciprocal of the energy relationship or mass between these two systems, for instance,  $f_{c,e} = m_e/m_p$  (45). The same is true for the reciprocal of the corresponding time relationship:  $f_{c,e} = f_{c,e}/f_p = f_{c,e}/1$  (rule of three, point 36.) We have shown that this reciprocity of space and time is the real basis of the theory of probabilities (point 37.). This fact explains why statistics is the preferred mathematical method of modern quantum mechanics. The above relationships also hold for the LRC:

$$\frac{v_{ex} v_{in}}{c^2} = \frac{v_a}{c^2} = \frac{LRK_e}{LRK_p} = \frac{U_e}{U_U} = SP(A) = n \quad (189d)$$

This new presentation of Bohr's third postulate confirms that in the past any physicist who has possessed a modicum of logical thinking has automatically

---

<sup>187</sup> The key finding of the new axiomatics that the aggregated tangential velocity of the electron and other elementary particles is  $n$  times greater than the square speed of light tells us that photon space time and the elementary particles are not final energetic entities, as is believed today, but are products of underlying levels of infinite greater energy and velocity. In this case, we must assume that these levels are the basic levels of energy that build the 3d-space-time of matter and photons, which we can only perceive at present. These levels will be the object of new transcendental physics that will be developed in the next millennium.

assessed the Universal Law in an intuitive manner in his particular area of interest. This will be illustrated for Bohr.

When we set the external tangential velocity  $v_{ex}$  from equation (189) in equation (182), we obtain the following relationship between the **radius**  $r$  of the electron orbit and the continuum of natural integers  $n$ , that is, the external time of the electron  $f_{ex} = n$ :

$$r = \frac{m_p \lambda_A^4}{\pi E_o q_p^2 f_{c,e}^3} n^2 \quad (190),$$

where  $m_p = 0.737 \times 10^{-50} \text{ kg}$  is the mass of the basic photon,  $\lambda_A = 2.99792458 \times 10^8 \text{ m}$  is the wavelength of the basic photon,  $E_o = 1/\epsilon_o = 0.11294 \times 10^{12} \text{ ms}^{-2}$  is the electric field of the photon level,  $q_p = 1.29669 \times 10^{-39} \text{ m}^2$  is the charge (area) of the basic photon, and  $f_{c,e} = 1.235589 \times 10^{20} \text{ s}^{-1}$  is the Compton frequency of the electron. All these quantities are new constants, which we have obtained for the first time by employing the novel axiomatics of the Universal Law. These constants have been derived from various conventional equations of classical mechanics, thermodynamics and electromagnetism, but they also hold in quantum mechanics. This is another proof for the consistent unification of physics accomplished in this volume.

When we calculate the quotient in front of  $n$  for the hydrogen ( $n = 1$  and  $Z = 1$ ), we acquire **Bohr radius**  $a_o$ , which is a fundamental [*1d-space*]-constant of quantum mechanics:

$$a_o = \frac{m_p \lambda_A^4}{\pi E_o q_p^2 f_{c,e}^3} = 0.0528995 \times 10^{-9} \text{ m} \quad (191)$$

The general formula of Bohr radius is given as follows:

$$r = \frac{a_o}{Z} n^2 = \frac{a_o}{Z} f_{ex}^2 \quad (192)$$

It says that the radius of the electron stationary orbit is proportional to the **square of integers**, that is, to the square external time  $f_{ex}$ . The second fundamental constant of classical quantum mechanics is, as expected, a time quantity - the Rydberg constant  $R = f$  from equation (180). Based on these two quantities of the electron, Bohr could easily derive Rydberg-Ritz formula (180) from his original equation (184) of the second postulate (194b). Below, we shall present a novel method of derivation that explains the epistemological background of Bohr's procedure in the light of the new axiomatics.

Equation (194b) below says that the frequency of the emitted photons is inversely proportional to  $n$ . In Bohr model, the stationary orbits of the electron are designated with the primary quantum number  $n = 1, 2, 3, \dots$ , beginning with the orbit next to the nucleus. In this formalistic procedure, Bohr uses the continuum of integers simultaneously as the **set of ordinal numbers** (numerals)  $n = 1st, 2nd$ , etc., and the **set of cardinal numbers** (cardinal numerals)  $n = 1, 2, 3, \dots$ . This fact of extreme epistemological importance has so far evaded the attention of physicists.

The knowledge that the radius of the electron orbits behaves proportionally to the square of the integers  $r \approx n^2$  (192) has been celebrated as a great achievement of theoretical physics. It builds the foundation of modern quantum mechanics, which describes the fine structure of matter in terms of **quantum numbers**. However, our epistemological analyses reveals that this “discovery“ is an application of the principle of last equivalence within mathematics. Although this conclusion is cogent from the above equations, we shall prove it in detail for didactic purposes.

We have shown that the electric charge is defined as the cross-sectional area of the particles in motion (chapter 6.2). In real terms, it is of minor importance whether this area is defined as the square circumference,  $Q = u^2 = 4\pi^2 r^2 = SP(A)[2d\text{-space}]$ , or the area of a circle:  $A = \pi r^2 = SP(A)[2d\text{-space}]$ . In both cases, the charge of the particle is proportional to its  $[2d\text{-space}]$ , which can also be expressed by the diameter  $d = [1d\text{-space}]$ . This degree of mathematical freedom is independent of the actual form of the system - it holds in any system or level.

Precisely for this reason, we define  $K_s = SP(A)[2d\text{-space}]$  as the **universal formula** of applied geometry. It is based on the axiom of reducibility within Euclidean space or any other geometric space that is equivalent to it (transitivity of mathematics). The charge (area) of any particle is a specific constant of its constant space-time. In real terms, this would say that the electron has the same cross-sectional area for all stationary orbits, independent of the radius of the orbit. When the paradigm “charge (area) in motion (rotation)“ is applied, this means that the cross-sectional area of the electron can be presented as a function of time:  $I = dQ/dt = K_s f = E_A$ . If we now define the electron as the basic action potential of the electron level of an atom  $E_{Ae} = I_e$ , then we can assess it as a product of its cross-sectional area and time:

$$E_{Ae} = I_e = Qf = Af = \pi r^2 f = K_s f \quad (193)$$

Let us now take two electrons with the radii,  $r_1$  and  $r_2$ , as two equivalent basic action potentials of the electron level. Their times are given as  $f_1$  and  $f_2$ . When we apply the axiom of conservation of action potentials, we obtain:

$$E_{Ae1} = \pi r_1^2 f_1 = E_{Ae2} = \pi r_2^2 f_2 \quad (193a)$$

We arrive at the same equation, if we alternatively consider all electrons in an atom as the constant action potential of this particle level of matter. When we present equation (193a) as a rule of three, we obtain the **reciprocity of charge (space)** and **time** (see point 36, equation (36-1)):

$$\frac{r_1^2}{r_2^2} = \frac{[2d - space]_1}{[2d - space]_2} = \frac{charg e_1}{charg e_2} = \frac{f_2}{f_1} \quad (194)$$

We can now set for the radius of the first orbit next to the nucleus the number  $r_1 = n = 1$  as the certain event or a numeral  $r_1 = n = 1st$ , as is done in Bohr model. Accordingly, we must write for the time  $f_1 = n = 1$  as the certain event, 1 *unit*, or the *first numeral*:

$$\frac{1}{n^2} = \frac{f_2}{1} = f_2, \text{ as } f_1 = 1 \text{ and } r_1 = 1 \quad (194a)$$

This simple derivation of the universal equation as a rule of three can be interpreted as follows: the time of the electrons is inversely proportional to the square of the natural integers. This is an iteration of the **inverse-square laws** of nature, which are a product of the two-dimensional presentation of space-time within geometric formalism. When Rydberg-Ritz formula is presented according to Bohr's postulates, we obtain for the extrinsic time of the electron  $f_{ex}$  the following new equation:

$$f_{ex} = \frac{f_p}{R} = \left( \frac{1}{n_2^2} - \frac{1}{n_1^2} \right) \quad (194b)$$

In equation (194b), the time of the electron is assessed as a quotient of the frequency of the emitted photon  $f_p$  and the Rydberg-constant, which has the dimensionality of time (principle of circular argument). Both equations, (194a) and (194b), are equivalent applications of the universal equation for the electron. Rydberg-Ritz formula assesses the vertical energy exchange between the electron level and the photon level in terms of time according to the principle of circular argument.

The use of the continuum of integers as quantum numbers has justifiably evoked the doubt among physicists that quantum mechanics is "not a true empirical discipline", as is still believed with respect to classical mechanics and electromagnetism, but a "mere mathematical formalism". As scientists have not been able to develop a coherent axiomatics based on the theory of knowledge, they still use this mathematical formalism and compound its complexity of presentation by inventing new tautological formulae. In their epistemological helplessness, they have resorted to additional non-mathematical

interpretations, such as the **Heisenberg uncertainty principle**, and have thus introduced new interpretational flaws into modern physics (see chapter 7.3). Physics, being applied mathematics, and mathematics, being a hermeneutic discipline of consciousness that exhibits an infinite propensity to evolve, have not only been the chief source of scientific knowledge, but also an intellectual trap for physicists. The growing complexity of mathematical instruments which they have introduced in physics has obscured the objective existence of the Universal Law. Any analysis of this fact must inevitably include the psychological and intellectual make-up of the scientist at the end of the second millennium; he is essentially a product of a negative social and intellectual adaptation.

## 7.2 SCHRÖDINGER'S WAVE EQUATION OF QUANTUM MECHANICS IS AN APPLICATION OF THE UNIVERSAL EQUATION

In 1924, **de Broglie** suggested that electrons may have wave properties. Since electromagnetic waves were known to behave as waves (Maxwell's electromagnetism) and particles (Planck's equation), it was quite logical to expect the same characteristics for matter. Departing from Planck's equation, de Broglie presented the following application of the universal equation as a rule of three:

$$\lambda = \frac{c}{f} = \frac{hc}{hf} = \frac{hc}{E} = \frac{hc}{pc} = \frac{h}{p} = \frac{SP(A)[2d - space]f}{SP(A)[1d - space]f} = [1d-space] \quad (195)$$

Although de Broglie's equation is applied to photon space-time, or more precisely, to the basic photon, it is generally believed to hold in matter - hence the concept of the **wave-particle dualism of matter**. The epistemological deficiency of this concept should be cogent to the reader. Tacitly, physicists have assumed that the properties of matter are determined by the properties of photon space-time. At the same time, they have continued to distinguish between matter with mass and energy without mass, that is, photon space-time, as is expressed in Einstein's equation  $E = mc^2$ . Until now there has been virtually no effort to explain the vertical energy exchange between matter and photon space-time. For this reason, physics has failed to integrate gravitation with electromagnetism. This is accomplished for the first time in the new axiomatics.

From equation (195), the kinetic energy  $E_{kin} = 1/2mv^2$  of low-energy electrons is calculated within mathematical formalism by introducing new quantities:

$$\begin{aligned}
E_{kin} &= \frac{mV^2}{2} = \frac{m^2V^2}{2m} = \frac{p^2}{2m} = \frac{SP(A)^2[2d - space - time]}{2SP(A)} = \\
&= SP(A)[2d-space-time] \tag{196}
\end{aligned}$$

We present this equation because it is basic to Schrödinger's wave equation. From equation (196), one can obtain the **non-relativistic momentum** of the particle  $p = \sqrt{2mE_{kin}}$  or the **wavelength**  $\lambda = \frac{hc}{\sqrt{2mc^2E_{kin}}}$ . Electrons with

energies in the order of 10 eV thus have **de Broglie wavelengths** in the order of nanometers. This magnitude gives the size of atoms and the spacing of atoms in a crystal. When electrons with this energy interact with a crystal structure, they are scattered in a similar way as x-rays. This is a proof that matter is of wave character (electron diffraction and interference, Davisson & Germer, Thompson, 1927).

In the new axiomatics, we regard each wave as an action potential with a constant mean specific energy for each source and medium. The evidence that atoms have the same space as electrons confirms that all systems of space-time are U-sets that contain themselves as an element - the electron contains the nucleus with the hadrons (protons and neutrons), while the latter contain the quarks and so on. Precisely for this reason, the electron level, which determines the crystal structure of matter, also determines the properties of the thermodynamic level - the thermodynamic behaviour (expansion and contraction) of materials depends on the energy exchange between these two levels. This aspect has already been discussed for the kinetic theory of gases in chapter 5.3.

In 1926, **Schrödinger** presented a wave equation of quantum mechanics that was analogous with the classical wave equation (61). With this equation he could describe the wave-particle character of particles, that is, of electrons, within mathematical formalism. Like the classical wave equation, Schrödinger's wave equation of quantum mechanics is an application of the universal equation. Schrödinger departs from the wave equation of electromagnetism (see equation (172)) and arbitrarily selects the abstract quantity **electric field**, that is, **acceleration**, as the basic quantity, with which the space-time of the particle should be assessed. This is another heritage of electromagnetism (see equations (174) to (177)). Historically, acceleration is the preferred quantity in physics - from classical mechanics to quantum mechanics, this pattern remains invariant. Within mathematics, this quantity assesses space-time as [1d-space-time] in the process of energy exchange, that is, in terms of time:  $E \Rightarrow a$ ,  $E = [1d-space-time] f = E_A f$ , where  $E_A = [2d-space] f = [1d-space] f = [n-d-space] f$ . As any quantum action potential can be given by the field of the particle, we can present any energy interaction between two quantum systems according to

the axiom of reducibility:  $E = E_{A1}E_{A2} = E_1E_2 = E^2$ . Schrödinger defines the square electric field *a priori* as the **wave function**  $|\psi|^2 = \psi \times \psi = E^2$  of the particle. This quantity is then assessed by the method of statistics. As  $SP(A) = n = \text{space-time}$ , any statistical magnitude which we obtain from a statistical test performed in the real world is either space, time, or a space-time quantity. These quantities are the actual “expected values“ of any statistical parameter. This also holds for the **wave function**:

$$|\psi|^2 = E^2 = [2d\text{-space-time}] f^2 \quad (197)$$

In terms of the theory of probability, this quantity is also called “**residence probability density of the photon**“, in German: “Aufenthaltswahrscheinlichkeitsdichte“, which is, indeed, an awful word. It is important to observe that, until now, quantum mechanics has not been in a position to explain this term epistemologically. This default is generally acknowledged - hence the feeling that quantum mechanics is a pure mathematical formalism, which is essentially true. In the new axiomatics this problem is solved by explaining the nature of the primary term. In this process we have proved that the probability set  $0 \leq SP(A) \leq 1$  is equivalent to the primary term. Any subset of it, such as  $|\psi|^2 = E^2$ , manifests the properties of space-time as defined for the first time in the new axiomatics. Bearing this in mind, we can easily perceive the traditional non-mathematical interpretation of the residence probability density of the photon as “the probability of a photon to occur in a certain volume, e.g. in the volume of the electron.“

In the traditional view of quantum mechanics, the space of the particle is regarded as void (vacuum); in this empty space the photon appears, so to say, out of “nowhere“. The absurdity of this idea should be cogent to everybody. Furthermore, it is quite remarkable that although Schrödinger’s wave equation is derived for the particles of matter, **it actually considers the basic photon**. Does this mean that electrons do not exist, but are merely another spatial form of organisation of photon space-time? If so, photons must also have space (charge) and mass, just as all material particles have space and mass, the aggregated product of which is defined as electromagnetism and matter. Quantum physics does not give any clear answer to these essential questions. It has simply overlooked them.

In the new axiomatics, space-time is discrete, but continuous, so that there is no vacuum. Any system of space-time can be regarded as a specific spatial configuration, for instance, as a superimposed, standing wave, which contains space-time as an element. If we depart from the term “photon space-time“ as a synonym for space (extent), we must expect that photons **form** the space of particles. If we consider the vertical energy exchange between matter, that is, between the particles of matter, and photon space-time, we must find the basic photon as an element of the particles of matter (U-sets). This axiomatic conclusion of the new theory is the epistemological background of the statistical

approach of Schrödinger's wave equation, which, in the light of the new axiomatics, is a simple differential equation of the Universal Law.

Within mathematical formalism, this equation renders **complex numbers** with the **imaginary unit**  $i = \sqrt{-1}$  as a possible solution. As all numbers are "object of thought", this imaginary unit has no real correlate - it is a surrogate of abstract mathematical operations. In the light of the new axiomatics, the epistemological origin of the imaginary number is very simple. We shall explain it for the first time in the history of science in a concise form because this aspect is closely related to current theoretical interpretations in quantum mechanics.

The application of the axiom of reducibility leads to the building of **square quantities** within the established geometric formalism of Euclidean space, as demonstrated for the electric field above. As the physical quantities of the interacting systems are usually presented one-dimensionally as vectors, the resultant quantity is two-dimensional in terms of space, time, or space-time (see equation (197)). If we employ the axiom of reciprocal LRC of contiguous levels to express the reciprocity of space and time in mathematical terms, we can present any two-dimensional quantity, such as  $|\psi|^2 = E^2$ , with the continuum of real numbers  $|\psi|^2 = E^2 = n=1$ , and its reciprocal counterpart with the continuum of negative numbers:  $|\psi|^2 = E^2 = -n = -1$  (degree of mathematical freedom). This is a very common approach in physics.

If we now build the **square root** of quantities, to which the number "-1" is attributed in a primary manner, we obtain the **continuum of imaginary numbers** from the continuum of negative numbers  $\sqrt{-1 \times n} = in$ . Thus the imaginary unit "i" and the complex numbers, which contain this unit as an element, are an intuitive correct perception of the reciprocity of space and time. The proof of existence of imaginary numbers is thus the primary term. When Schrödinger's wave equation is applied to the real world, the solutions that give complex numbers are eliminated by convention. This is a rare example of common sense in quantum mechanics.

As already stressed on many occasions, we can assess the two canonically conjugated constituents of space-time only after we have separated them mentally in our mind, that is, in mathematics, which is a hermeneutic discipline of mathematical consciousness. We have shown that this distinction of reciprocal space and time is the origin of differential and integral calculus. The same is true for statistics: we can assess space-time through a subset thereof (random sample), by determining either its space or time magnitudes. This is precisely the objective of Schrödinger's wave equation. It acknowledges intuitively this epistemological background and describes the space-time of the particles either as a spatial (area) integral, by setting the time as the certain event  $f=1/dt=SP(A)=1$  (**time-independent Schrödinger equation**), or as a space-time function by setting the time as a statistical variable:  $0 \leq f = 1/dt = SP(A) = \sin(kx - \omega t) \leq 1$  (**time-dependent Schrödinger equation**). Schrödinger's wave equation departs from the classical wave equation (58) which is now written for the electric field (accele-

ration) as a quantity of photon (electromagnetic) space-time (see equations (172) to (176)):

$$\frac{\partial^2 E(x,t)}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 E(x,t)}{\partial t^2} = \frac{1}{LRC_p} \frac{\partial^2 E(x,t)}{\partial t^2} \quad (198)$$

The space-time of the photon level is regarded as a harmonic wave and is expressed by the cosine function (see chapter 4.3). In equation (198), the square electric field can be differentiated twice with respect to time  $f = 1/dt$  and space. When these derivatives are calculated in the cosine function<sup>188</sup>, a simple relation is obtained between the *angular velocity*  $\omega = [1d\text{-space-time}]$  (equation (17)), which is erroneously regarded as angular frequency  $\omega = 1/[1d\text{-space}] = f$  and the *wave number*  $k = 2\pi/\lambda = SP(A)$  (equation (55)):

$$k = \frac{\omega}{c} = \frac{[1d - space - time]}{[1d - space - time]} = SP(A) \quad (199)$$

Equation (199) illustrates that as soon as the new space-time symbolism is applied, we do not need the complex derivation by cosine function and differential calculus (equation 198)) to acquire this simple relationship. We can build it *ad hoc*. Equation (199) embodies the **equivalence between rotations and waves: rotation = wave**. Both are aspects of one and the same thing - energy exchange that manifests itself as closed motion. There is no possibility of distinguishing between a rotation and a wave in real terms. This equivalence is the essence of the classical wave equation (chapter 4.5). Based on equation (199), the frequency (time) of the photons can be given in terms of the angular velocity:

$$f = \frac{c}{\lambda} = \frac{\omega}{2\pi} = \frac{[1d - space - time]}{[1d - space]} = f \quad (199a)$$

This is a very useful application of the universal equation as a rule of three. It is used to rearrange the equation of the total energy of an electromagnetic wave  $E_{total} = E_{kin} + E_{pot}$  as follows:

$$E_{total} = hf = \frac{h\omega}{2\pi} = \hbar\omega = \frac{\hbar^2 k^2}{2m} + E_{pot} = SP(A)[2d\text{-space-time}] \quad (200)$$

<sup>188</sup> For details see PA Tipler, chapter 36.5, p.1234 (German ed.).

When we substitute the LRC of the photon level in equation (198) with the total energy of the photons as given in equation (200), we obtain the **time-dependent Schrödinger equation** of quantum mechanics:

$$-\frac{\hbar^2}{2m} \frac{\partial^2 \Psi(x,t)}{\partial x^2} + E_{pot}(x,t) \Psi(x,t) = i\hbar \frac{\partial \Psi(x,t)}{\partial t} \quad (201)$$

This equation is called “time-dependent“ because the potential energy is expressed as a function of space and time  $E_{pot}(x,t)$ . In the classical tradition, the concept of potential energy reflects the static view of the world which eliminates the energy exchange in an abstract way in the mind. In the time-dependant Schrödinger equation (201), this abstract subset of space-time is given as a function of time. This engenders serious theoretical problems in quantum mechanics. The objective is thus to arrive at a new formalistic presentation of Schrödinger’s wave equation in which the variable constituent *time* that gives the amount of energy exchange no longer appear.

What is the method that Schrödinger selected? The new axiomatics makes clear that the only way of eliminating time in an abstract way is to arrest the time in the mind by defining it as the certain event  $f = 1/dt = SP(A) = 1$  or 1 *unit*. Thus any mathematical procedure which eliminates time as a variable inevitably uses the primary number “1“. According to the principle of last equivalence, this number is equivalent to space-time (primary term). Schrödinger uses exactly this procedure to eliminate time and to acquire a *time-independent* wave equation, We shall unveil this complex procedure step by step, for it is a common method not only in physics, but also in pure mathematics. At first, the wave function is expressed in the **exponential form** by placing the conventional time  $t$  in the exponent:

$$\Psi(x,t) = \psi(x)e^{-i\omega t} \quad (202)$$

Thus the wave function is artificially separated in a *time-independent* part  $\psi(x)$  and a *time-dependent* exponent of the constant:  $e^{-i\omega t}$ . This is a frequent procedure leading to the derivation of various **exponential laws** as applications of the universal equation (see chapter 4.1, equations (53) to (53b)). In this form, the equation is still time-dependent. In a second step, the exponential is compared with itself (building of a relationship) and the certain event is obtained:  $e^{-i\omega t} / e^{-i\omega t} = SP(A) = 1$ . The actual procedure is as follows: Schrödinger’s wave equation is given in the exponential form and all terms are divided by the exponential. This is common method in mathematics that is an application of the principle of circular argument:

$$-\frac{\hbar^2}{2m} \frac{\partial^2 \Psi(x)}{\partial x^2} e^{-i\omega t} + E_{pot}(x) \Psi(x) e^{-i\omega t} = E \Psi(x) e^{-i\omega t} \quad | : e^{-i\omega t} \quad (203)$$

The result of this division is the **time-independent Schrödinger equation**:

$$-\frac{\hbar^2}{2m} \frac{d^2 \Psi(x)}{dx^2} + E_{pot}(x) \Psi(x) = E \Psi(x) \quad (204)$$

Equation (204) is a simple differential presentation of the universal equation using the method of divergence (Laplace-operator) as discussed in chapter 6.6 (equations (122) & (123)). The solutions of this equation are derivatives with respect to space  $dx^2$  and are therefore **real** numbers (geometric presentation). Equation (204) solves for the potential energy in the **stationary case**:

$$|\Psi(x, t)|^2 = |\Psi(x)|^2 \quad (204a)$$

In terms of statistics, this function is *a priori* defined as **continuous** (stetig), although no proofs are furnished for this assumption. Based on the nature of the primary term, we define space-time as continuous, but discrete. The concept of discontinuity involves the existence of vacuum, which has been axiomatically eliminated as an N-set. Classical quantum mechanics, on the contrary, is based on a paradox - on the one hand, it regards the basic photon as a mass point with a zero space that occurs in the empty space of the particle; on the other hand, it assumes that its spatial distribution in the particle is continuous. The absurdity of this outlook is self-evident. In practice, the solution of the time-independent Schrödinger equation is reduced to finding the **areal integral** of the space of the particle that is awkwardly called the **residence probability density of the photon**:

$$\int_{-\infty}^{+\infty} |\Psi(x)|^2 dx = SP(A) = 1 = \text{space-time} \quad (205)$$

This equation is called the **standardization condition** (Normierungsbedingung) of Schrödinger's wave equation. In fact, it is a definition of the *certain event* for the space of any particle. To acquire this final result, we need not derive Schrödinger's wave equation in the aforementioned complex manner. Equation (205) is an application of the principle of last equivalence for the microcosm. The building of equivalences between the number "1" and the parts is a common mathematical method of physics. It reflects the only method of building mathematical equations according to the principle of circular arguments as an application of the principle of last equivalence for the parts.

In the next chapter, we shall show that Heisenberg has used the same method to introduce his famous and highly overestimated “uncertainty principle“.

Before we discuss this principle, we shall finally prove that we can quite easily obtain Schrödinger’s standardisation condition of the particle when we depart from the classical quantity of **density**  $\rho = SP(A)/[1d\text{-space}]$  (see equation (47)). When we solve for the probability  $SP(A)$  in this simple equation, we obtain a formula that is equivalent to equation (205):

$$SP(A) = \rho[1d\text{-space}] = 1 \quad (206)$$

Physics can, indeed, be “as simple as cooking a bean soup“<sup>189</sup>, provided we have the right epistemological approach to nature - the new axiomatics of the Universal Law. This holds for all empirical sciences. This is the actual revolution predicted by many people at the end of the second millennium. Equation (206) illustrates repeatedly the intrinsic propensity of mathematics to produce an infinite complexity of symbols, which can be axiomatically derived from the universal equation as a rule of three.

*Exercises:*

1. Express the *group velocity* of *wave packages* in the new space-symbolism and discuss the term “wave packages“ in the light of the new axiomatics. Prove that the term “wave package“ is a synonym of the term “particle“. Discuss de Broglie’s wave-particle dualism in this respect.
2. Present a particle in a *box potential* in the new space-time symbolism.
3. Interpret *Bohr’s principle of correspondence* within the new axiomatics.
4. Show by selected examples that all “*expected values*“ in quantum mechanics are space, time, or space-time relationships.
5. Express Schrödinger’s wave equation in three dimensions in the new space-time symbolism. Discuss the geometric method of this expression.
6. Prove that Schrödinger equation for two identical particles is an application of the axiom of reducibility.
7. Explain *Mendeleev’s periodical system* with the Universal Law. Discuss the concepts of *covalent bonding* and *molecular orbit* within the new axiomatics. Try to envisage the consequences of the new theory for chemistry and other related disciplines (see volume III).

---

<sup>189</sup> A Bulgarian saying for something that is so simple that even an idiot would grasp it - for instance, all Bulgarians can cook a bean soup.

8. Show that the phenomenon of **nuclear magnetic resonance** (NMR) is a concrete manifestation of the Universal Law.

*Solution:*  $hf = \Delta E = 2(\mu_z)_p B = SP(A)[2d\text{-space}]f_{\mu}f_B = SP(A)[2d\text{-space-time}]$ , where  $\mu_z$  is the magnetic moment of the proton within an external magnetic field  $B$  with the photon energy of  $\Delta E$ .

### 7.3 HEISENBERG UNCERTAINTY PRINCIPLE IS AN INTUITIVE NOTION OF THE UNIVERSAL LAW

**Heisenberg uncertainty principle** was postulated at the same time as Schrödinger published his equation. Since then, it is considered to be the basic explanatory principle of quantum mechanics in terms of cognitive knowledge. Its interpretations are numerous and rather confusing. In this survey, we shall focus on the mathematical presentation of this principle, as we have come to the conclusion that all non-mathematical interpretations in physics contain inherent inconsistencies, while mathematics is the only adequate perception of space-time.

Heisenberg accepts uncritically the geometric approach of quantum mechanics as presented in Bohr model and Schrödinger's wave equation. In accordance with Bohr and Schrödinger, he regards the particles as mass points with zero space that rotate (move) in empty space. According to classical mechanics, the *initial conditions* of such mass points can be exactly determined (initial-value problem). In chapter 3.1 we have proved that this is a false idea nurtured in the realm of mathematical formalism and has no correlate in the real world. All real systems of space-time have space and time, and any particular space of a system has a specific constant (finite) magnitude, which can be expressed with a number  $x$  belonging to the continuum of real numbers  $n$ , or with a probability belonging to the probability set  $SP(A)$ , where  $n = SP(A)$ . Furthermore, we have unveiled that any probability obtained in the real world is space (geometric magnitude), time (dimensionless number), or space-time relationship (dimensionless number). This is the epistemological background of mathematics as embodied in the theory of sets. As physics is applied mathematics, this also holds for this empiric discipline. The proof of existence for both disciplines which are promulgated in the new axiomatics is that space-time (energy) and continuum are equivalent concepts of the primary term (axiom of last equivalence). In the light of this introduction, the interpretation of Heisenberg uncertainty principle is fairly simple.

Heisenberg departs from the idea that particles behave as a **wave packet** as described in wave theory. We use the same approach to present the **action potential** as a **superimposed standing wave in motion** (chapter 4.6). The outstanding characteristic of a wave packet is that, when its *duration*  $\Delta t$  beco-

mes very short, the *range of frequencies*  $\Delta\omega$  becomes very large. The product of the two quantities is usually set equivalent to 1 (certain event):  $\Delta\omega\Delta t = 1$  (see equation (60)). We have shown that the quantity “range of frequencies“ is a pleonasm of angular velocity. When this equation is expressed in the new space-symbolism,  $\Delta\omega\Delta t = [1d\text{-space-time}] / f = [1d\text{-space}] = SP(A) = 1$ , we obtain the classical definition of the extent (space) of the wave packet that is assessed one-dimensionally as the certain event or 1 *unit*. This definition takes place within mathematics and can be applied to any wave packet (degree of mathematical freedom). We might as well set the above equation equal to any number or probability value, and it will still remain true.

This equation can be expressed in many different ways by using various abstract quantities (tautology of mathematics). For this purpose, Heisenberg uses the classical quantity of mechanics, the momentum, or more precisely, its pleonastic expression - the *impulse*  $\Delta p = F\Delta t = p = SP(A)[1d\text{-space-time}]$  (equation (15)). He establishes a reciprocal relationship between the impulse  $\Delta p$  and the time of collision (contact time)  $\Delta t$ , on the one hand, and the space of the wave packet (pulse)  $\Delta x = [1d\text{-space}]$ , on the other. In this case, the wave packet symbolizes a photon (an electromagnetic wave), which interacts in a vertical energy exchange with the particles of matter and allows the measurement of their space-time, for instance, in Compton scattering. Heisenberg comes to the following conclusion: the greater the impulse of the wave packet or the shorter the time of collision between the wave packet (photon) and the particle, the more exact the determination of the location of the particle. The latter is regarded as a mass point with zero space moving randomly in empty space.

Although this statement is an intuitively correct perception of the reciprocity of space and time (see below), it contains a classical flaw of physics that has prevented physicists from discovering the Universal Law. The logical fallacy of Heisenberg uncertainty principle can be summarized as follows. According to the quantization idea of Bohr, which is expanded by Schrödinger in his wave equation, the particle residing in the empty space attributed to this particle (tautology) is not the particle itself, but the basic photon  $h$  as an element of the particle (U-subset). The basic photon is imagined to be confined in the predetermined space of the particle, for instance, in the space of the electron. However, Heisenberg, in particular, and quantum mechanics, in general, do not explain how the confinement of this empty space of the particle is actually accomplished.

This observation might be embarrassing to traditional quantum mechanics, but it is unavoidable for our further elaboration. As there is no vacuum, any real particle **is its own space in rotation**. This is very important to remember. The correct interpretation of Heisenberg’s conclusion should be: the greater the impulse of the photon, and the shorter the time of interaction between the photon and the particle, the smaller the space of the particle. This statement is identical with the axiom of conservation of action potentials. This becomes

obvious when we present the uncertainty principle in the mathematical form chosen by Heisenberg (see also equation (200)):

$$\begin{aligned}\Delta p \Delta x &= SP(A)[1d\text{-space-time}][1d\text{-space}] = \\ &= E_A = hf = h(\omega/2\pi) = (h/2\pi)\omega = SP(A) = 1\end{aligned}\quad (207)$$

The particle that is regarded as an action potential and expressed as the product  $\Delta p \Delta x$  is set equivalent to the interacting photon, which is regarded as an action potential  $E_A$ . In Heisenberg uncertainty principle, these two entities (axiom of reducibility) are not clearly distinguished - hence the confusion with the particle as the basic photon within its confinement. Nevertheless, it is true that space-time is an U-set, which is contained as an element in all systems and levels. As space-time is incessantly exchanged between the systems, it is not possible to distinguish the space-time of photons from that of particles. Equation (207) is one possible expression of the axiom of conservation of action potentials. Within mathematical formalism we can, for instance, set the angular velocity as  $\omega = SP(A) = 1$ . In this case, we can present equation (207) as follows:

$$\Delta p \Delta x = \hbar = SP(A) = 1 \quad (207a)$$

Alternatively, we can assign the above equation any number or probability value without changing its validity. If we consider Schrödinger's wave equation, which gives an asymmetrical solution for the electron (fermion, hemisphere), while photons are presented as symmetrical harmonic waves, we may choose to consider this result in the above equation:

$$\Delta p \Delta x = SP(A) \geq \frac{1}{2} \hbar = \frac{1}{2} \times 1 = \frac{1}{2} \quad (208)$$

Equation (208) is a frequent mathematical presentation of Heisenberg uncertainty principle. Theoretically, we can assign the action potential of the particle any other number or express it with different quantities, e.g. energy and conventional time. As a result we obtain another frequent mathematical presentation of Heisenberg uncertainty principle:

$$\Delta t \Delta E = SP(A)[2d\text{-space}]f = E_A \geq \frac{1}{2} \hbar \quad (208a)$$

In this context, it is of historical interest to observe that Heisenberg has independently developed an equivalent mathematical expression of Schrödinger's wave equation of quantum mechanics by employing mathematical *matrices*

from the theory of sets. This illustrates the redundancy of physical endeavour as applied mathematics.

We are told that an important consequence of Heisenberg uncertainty principle is:

„the existence of a minimal kinetic energy, the so called **zero point energy**, which a particle always conserves when it is enclosed in a finite space. Consider now a particle with the mass  $m$  that is enclosed in the one-dimensional volume of  $l$ . The *uncertainty* cannot be greater than  $l$ , hence the impulse uncertainty is  $\Delta p \geq \hbar / 2l$ . As the magnitude of the impulse must be at least as big as its uncertainty, the kinetic energy is at least:

$$E_{kin} = \frac{1}{2} m v^2 = \frac{\hbar^2}{8ml^2} = SP(A)[2d\text{-space-time}] \quad (209)$$

From this we should conclude that there is always a zero point energy, the magnitude of which is inversely proportional to the volume  $l$ .<sup>190</sup>

The absurdity of these statements should be cogent to the reader. This is the stuff of modern quantum mechanics. Therefore, we should not be surprised to establish that most physicists do not understand this discipline. It begins with the use of such terms as “uncertainty“ with a highly uncertain connotation. The explanation of this ambiguous physical terminology should be done with respect to history. Today, Heisenberg uncertainty principle is presented in terms of statistics, but when it was first postulated in 1926, the theory of probability had not yet been developed. Kolmogoroff introduced the concept of probability axiomatically in 1933<sup>191</sup>. Subsequently, the term “uncertainty“ has been used in the same connotation as the term “probability“. We have shown that any probability value has the real magnitude of space or time. In this sense, the above statement “the uncertainty cannot be greater than  $l$ “ becomes clear. The same holds for the statement that “the magnitude of the zero point energy of the particle is inversely proportional to its volume“ - it is an intuitive perception of the reciprocity of energy and space.

Thus Heisenberg uncertainty principle can claim the status of a principle - its principal flaw is, however, that it is an incomplete, partial perception of the nature of space-time and therefore of little cognitive value.

<sup>190</sup> From PA Tipler, p. 1231-1232 (German ed.)

<sup>191</sup> Grundbegriffe der Wahrscheinlichkeitsrechnung, Springer, Berlin, 1933.

#### 7.4 SELECTED SOLUTIONS OF QUANTUM MECHANICS IN THE LIGHT OF THE UNIVERSAL LAW

In this chapter, we shall present some key solutions of quantum mechanics, which are paradigmatic for the new approach in this field. Based on these examples, the reader should be able to apply the new axiomatics to any problem of quantum mechanics, quantum electrodynamics, QED, or quantum chromodynamics, QCD. We begin with the presentation of a conventional SI unit that is specific for quantum mechanics.

##### 1. Example: What is Electronvolt ?

While in classical mechanics the SI unit for energy is *joule*, in quantum mechanics the SI unit **electronvolt [eV]** is commonly used. It is obtained by applying the axiom of reducibility for the interaction between an electron given as area (charge)  $e$  and any electromagnetic system expressed by its  $LRC = U = 1m^2s^{-2}$ :

$$E = 1 eV = eU = SP(A)[2d-space-time] = 1.602 \times 10^{-19} m^2 \times 1 m^2 s^{-2} = 1.602 \times 10^{-19} m^2 s^{-2} [= CV] \quad (210)$$

It is important to observe that when the area of the electron given as charge is multiplied with the area of an electromagnetic system included in its  $LRC$ , e.g. as an area integral of the electric gradient, we obtain again area ( $[2d-space]$ ) within geometric formalism (see also the discussion in conjunction with the term “electric dipole“ (114) in chapter 6.4). The method of definition and measurement of the SI unit “electronvolt“ is an intuitive notion of the primary term (primary axiom) as an “area (charge) in motion“. We have shown that this is a basic paradigm of many physical laws as applications of the Universal Law.

The unit  $eV$  is obtained from the basic SI unit of energy *joule* by using the following conversion factor as an *absolute constant*:

$$K_{1,2} = \frac{1eV}{1joule} = \frac{1.602 \times 10^{-19} m^2 s^{-2}}{1m^2 s^{-2}} = 1.602 \times 10^{-19} \quad (211)$$

The absolute constant (conversion factor)  $K_{1,2}$  is a *dimensionless* number that belongs to the probability set  $K_{1,2} = SP(A)$  (point 38.). The electronvolt and its conversion factor allow an easy comparison of the space-time (energy) of the

particles in terms of their constant space and time magnitudes, usually presented as natural constants, e.g. Compton wavelength, Compton frequency and charge, or as abstract quantities thereof, e.g. rest energy, rest mass, relativistic impulse, energy, mass etc. This is the only exercise of quantum mechanics, as we shall prove by further examples.

## 2. Example: Rest Mass and Binding Energy of Hadrons

We have shown on many occasions throughout this book that mass is a relationship of the space-time (energy) of systems, whereas the initial reference system is the basic photon  $h$  as expressed by its surrogate  $1\text{ kg}$  through the conversion factor (see equation (45b)):

$$\begin{aligned} K_{1,2} &= 1 \text{ reference weight}/1h = E_g/h = mv^2/m_p c^2 = \\ &= SP(A)_g / SP(A)_p = 1 (kg)/m_p = 1/0.737 \times 10^{-50} = 1.357 \times 10^{50} \end{aligned} \quad (212)$$

Alternatively, we can use the mass of the basic photon  $m_p = SP(A) = 1$  as the original unit of mass and express the SI reference unit of mass  $kg$  as a relationship thereof:  $1\text{ kg} = 1.357 \times 10^{50} [m_p]$ . These are variations within mathematical formalism, which have no influence on the actual space-time relationships of the systems. As space-time is closed, we can depart from any reference relationship (mass) or, alternatively, from its reciprocal and obtain any other relationship by experiment or calculation of known data.

Equation (212) is the method of definition and measurement of the **rest mass** of particles with respect to the energy unit *electronvolt*. It is usually written as:

$$\begin{aligned} m_{rest} &= (x) \text{ MeV}/c^2 = E/m_p c^2 = mv^2/c^2 = m^2 s^2 / m^2 s^2 = SP(A), \\ &\text{when } m_p = SP(A) = 1 \end{aligned} \quad (213)$$

This presentation confirms again that photon space-time, as expressed by its  $LRC = c^2$ , is the basic reference system of physics, which is introduced through the principle of circular argument. It appears as a “hidden definition“ in classical mechanics ( $G$ ), theory of relativity (Lorentz factor, chapter 8.3), and quantum mechanics (unit of energy). We shall illustrate this approach for the **rest energy** and **mass** of free hadrons and for their **binding energy** in the nucleus. These quantities are used in conventional physics to prove the equivalence between energy and mass, and the validity of the theory of relativity in quantum mechanics.

When *protons* and *neutrons* are not bound, they have a constant **rest mass** and **energy** that can be derived from the mass  $m_p$  and energy  $h$  of the basic photon by applying the universal equation (see also chapter 3.9 and Table 1):

$$m_{pr} = m_p f_{c,pr} = 1.6726231 \times 10^{-27} \text{ kg} \quad (214)$$

$$m_n = m_p f_{c,n} = 1.6749286 \times 10^{-27} \text{ kg} \quad (214a)$$

Furthermore, we have shown that the *molar mass*  $M$  of the chemical elements, that is, their macroscopic mass, can be obtained from the above equations by using the universal equation as proven for the hydrogen atom (equation (46b)):

$$M_H = m_{pr} N_A = m_p f_{c,pr} N_A \quad (214b),$$

where the **atomic mass unit** (see equation (46)) is defined as follows:

$$1u = 1g / N_A \cong m_p f_{c,pr} = 0.737 \times 10^{-50} \times 2.26 \times 10^{23} = 1.66 \times 10^{-27} \text{ kg} \quad (215)$$

The **rest energy** of the *atomic mass unit* is obtained from the universal equation:

$$E_u = (1u)c^2 = m_p f_{c,pr} c^2 = 14.92 \times 10^{-11} \text{ joule} \cong 931.5 \text{ MeV} \quad (215a)$$

The above values reflect the current precision in physics. As they are transcendental magnitudes in reality, their expression with closed, real numbers is an arbitrary approximation within mathematical formalism. This observation is very important, as it precludes an unreflected criticism on the part of physical fetishists who pay great attention to alleged exactness of physical experiments and calculations and at the same time profoundly neglect the search for a genuine knowledge of nature.

When protons and neutrons are bound in the nucleus, their total rest mass and rest energy is less than their rest mass and energy in a free state. For instance, if the mass of the proton ( $^1\text{H}$ -atom) is  $m_{pr} = 1.007825 u$  and that of the neutron  $m_n = 1.008665 u$ , the rest mass of the nucleus of the element *helium* (He) is **0.030377 u** less than the sum of the rest masses of the four hadrons (2 protons and 2 neutrons) in a free state. This energy difference is called **binding energy** - it gives the amount of photon energy emitted by the free particles in order to bind to a helium nucleus, which is the new resultant system out of this interaction. One also speaks of **mass defect**. Thus, the binding energy (mass defect) assesses the vertical energy exchange of the free particles with photon space-time that mediates a horizontal interaction between them - their binding to a He-nucleus (axiom of reducibility).

As we see, any horizontal energy exchange involves a vertical exchange and vice versa (U-sets). There is no exception to this rule (see also the mechanism of gravitation in chapter 4.8). When we apply the universal equation to the **binding energy**  $E_b$ , we obtain the following formula:

$$E_b = m_p f_b c^2 = m_b c^2 = SP(A)[2d\text{-space-time}] \quad (216)$$

The time  $f_b$  of the binding energy gives the time (frequency) of the photons which the hadrons emit during their interaction that results in the building of a He-nucleus. Equation (216) departs from  $m_p$  as the basic (smallest) unit of mass (energy relationship) that is known at present and assesses the energy of the other particles in relation to it, that is, as **rest mass** of the particles. This is the “whole chebang”<sup>192</sup> of the famous *Einstein's equation* postulating an equivalence between energy and mass - it is a simple application of the universal equation for the vertical energy exchange between matter and photon space-time. So far, this equation has been proven only one way - through the energy exchange from the particles of matter given as mass to photon space-time given as energy. In this case, the binding energy is calculated as free photon energy.

If we now apply equation (216) to the binding energy of the Helium-nucleus with the *mass defect* of  $m_b = 0.030377 u$ , we can easily calculate the time (frequency) of the emitted photons: This magnitude can be experimentally determined:

$$\begin{aligned} E_{b-He} &= (m_p f_b) c^2 = 931.5 \text{ MeV} \times 0.030377 u = 28.296 \text{ MeV} = \\ &= 45.33 \times 10^{-13} \text{ joules } [m^2 s^{-2}] \end{aligned} \quad (217)$$

$$f_b = E_{b-He} / m_p c^2 = 45.33 \times 10^{-13} / 0.737 \times 10^{-50} \times 9 \times 10^{16} = 6.834 \times 10^{21} \quad (217a)$$

The frequency of the emitted photons is in the range of *gamma radiation* that is usually observed in nucleus decay (conservation of energy). The use of the basic mass  $m_p$  facilitates the calculations of quantum mechanics to an extraordinary extent. With this constant we can express all energy interactions between weak, strong and electromagnetic forces in a simple, straightforward and consistent way by incorporating all experimental and theoretical (mathematical) results of QED, QCD and GUT. We shall leave this tedious, iterative task to professional physicists who may fear disoccupation after the scientific community has realized that physics is applied mathematics, and will only draw attention to the fact that such efforts do not enrich our physical knowledge of nature.

---

<sup>192</sup> „The Whole Chebang“ is the title of a book by Timothy Ferris, Weidenfeld and Nicolson, London, 1997, which is representative of the thrash that is written in the field of popular physics nowadays. This also holds for all popular scientific journals.

### 3. Example: The Mass of the $\pi$ -Mesons (Pions) is a Function of the Mass of the Basic Photon

In this volume, we have obtained the mass of electrons, protons and neutrons from the mass of the basic photon  $m_p$  (see Table 1) These particles are conventionally defined as **fermions** with a half spin (angular momentum, asymmetric waves, Pauli exclusion principle). The geometric background of this concept has been explained. Now we shall apply the universal equation to **mesons** which, together with photons, are subsumed under the group of **bosons**. These particles have an integer spin (symmetric harmonic waves). These categories of particles represent mathematical circumlocutions of various forms of rotations or standing waves. They reveal that the standard model is a reductionist taxonomy based on descriptive terms of hidden, unanalysed mathematical origin.

The basis of *quantum chromodynamics* was laid in 1935, when Jukawa predicted the existence of the  **$\pi$ -meson** by applying inconsciously the universal equation for this particle. He was awarded the Nobel prize for this theoretical achievement, only after this particle was experimentally confirmed in 1947. This fact illustrates the priority of mathematical consciousness over empiricism. Jukawa's considerations were fairly simple. He assumed that the [1d-space]-quantity of this particle must be about  $1.5 \times 10^{-15} m$ . This was the estimated magnitude of the atomic diameter at that time. By applying the universal equation, he estimated the energy of this meson in the order of  $130 \text{ MeV}$  or  $2.089 \times 10^{-11} \text{ joule}$ . In the meantime, it has been established that there are three  $\pi$ -mesons:  $\pi^+$ -meson and  $\pi^-$ -meson with the rest energy of  $139.6 \text{ MeV}$ , and  $\pi^0$ -meson with the rest energy of  $135 \text{ MeV}$ <sup>193</sup>.

The exact measurement of the space-time of any system depends exclusively on the exactness of measurement of its constituents, which can only be assessed in a separate way. Quantum mechanics usually departs from space-magnitudes, for instance, from Compton wavelength or charge which are defined and measured by the geometric method. As the nature of the second constituent time is not well understood, this quantity is rarely used. Given the fact that the universal equation is a rule of three, we only need to know two magnitudes of a particle to determine the third one. We can therefore completely describe any particle through its three constant magnitudes - space, time and space-time. We shall now illustrate this basic objective of quantum mechanics by employing the universal equation in calculating the hypothetical **rest mass** and **rest energy** of the  $\pi$ -meson. For this purpose we shall assume within geometry that the *Compton wavelength* of the *proton*  $\lambda_A$  is equal to the [1d-space]-quantity of this boson. Essentially the same method was used by Jukawa in his original estimation of the energy of the meson:

---

<sup>193</sup> PA Tipler; Physics Letters, Vol 170B, Review of particle properties, Particle Data Group, 1986.

$$m_{meson} = m_p \lambda_A / 2\pi \lambda_{c,pr} = 0.266 \times 10^{-27} \text{ kg} \quad (218)$$

$$E_{meson} = m_{meson} c^2 = SP(A)[2d\text{-space-time}] = 149.2 \text{ MeV} \quad (218a)$$

If we set the Compton wavelength of the proton as an estimated [1d-space]-quantity of the meson, we obtain a somewhat higher value for the energy of this particle than is experimentally measured at present or predicted by Jukawa. Alternatively, we can depart from the experimentally determined values of the energy of the three mesons and obtain from the above equations their space and time magnitudes. We leave this experimental verification of the Universal Law to empirical fetishists. Equations (218) and (218a), or a derivation thereof, can be applied to any particle. This leads to the integration of QED, QCD and GUT in the new axiomatics.

#### 4. Example: Annihilation of Particles and Antiparticles

When Schrödinger's wave equation is presented relativistically, the resultant **Dirac equation** assumes the existence of particles and **antiparticles** with a 1/2-spin (angular momentum). This is applied geometry to the physical world. Particles and antiparticles are circumlocutions of destructive interference (waves out of phase) of microscopic systems that are regarded as asymmetric standing waves. Purely for this reason, it is postulated that particles and antiparticles always occur in pairs, but never alone. This is a key message of the standard model. However, the language of quantum mechanics is such a mess in this respect that it needs a Hercules' effort to clean the Eugean stables of this discipline.

The **annihilation of particle-antiparticle pairs** is a common energy interaction that is observed in quantum mechanics. We shall prove that it also obeys the Universal Law. Let us take the horizontal-vertical energy exchange between a *proton* and an *antiproton* written as follows:

$$p^+ + p^- = \gamma + \gamma$$

This equation gives the complete transformation of the energy of the *particle-antiparticle pair* in photon space time. It is an application of the axiom of conservation of action potentials. If we regard a proton and an antiproton as two action potentials with the same energy (space-time) which are out of phase, e.g. as two asymmetric standing waves that can interfere at any time and annihilate each other by destructive interference (see wave theory), this would mean that their energy is completely transformed into the energy of two opposite photons with the energy of  $\gamma$ . The *rest energy* of a proton and an antiproton on the left side is:  $E_{pr} = E_{anti-pr} = m_{pr} c^2 = m_p f_{c,pr} c^2 = 938 \text{ MeV}$  (see Table 1). According to the axiom of conservation of action potentials, this energy is equivalent to the energy of each of the two photons emitted in opposite

directions:  $E_\gamma = hf_\gamma = m_p c^2 f_\gamma$ . From this equivalence, we come to the conclusion that the Compton frequency of the proton and its antiparticle is equal to the frequency of the emitted photons:  $f_{c,pr} = f_\gamma$ . This is a fundamental axiomatic conclusion from the axiom of conservation of action potentials that holds for the annihilation of any particle-antiparticle pair. This can be proven experimentally. We come to the same result if we solve the universal equation as given in (25-1) for the **wavelength** of the emitted photons by setting the energy of the emitted photons  $E_\gamma$ :

$$\lambda_{c,pr} = hc/E_\gamma = 1.32 \times 10^{-15} m \quad (219)$$

We find that the wavelength of the emitted photons is exactly in the order of the **Compton wavelength** of the **proton** and the **antiproton** (see Table 1). The latter is a fundamental constant of quantum mechanics. This is a remarkable result, not only because it brilliantly confirms the validity of the Universal Law for the “world“ and “anti-world“, but also because it raises a fundamental cognitive issue. Although the proton and its antiparticle have the same wavelength as the radiated photons, fermions (protons and antiprotons) and bosons (photons) have a different structural complexity. The reason for this is that the proton is a superimposed wave that can be regarded as the product of two rotations - the intrinsic rotation of the particle with the intrinsic time  $f_{c,pr}$  and space  $\lambda_{c,pr}$  and the extrinsic rotation of the particle assessed as a spin (angular momentum) according to the axiom of reducibility. The latter quantity has its own extrinsic time and space. This outlook of the new axiomatics affects another great simplification in the theory of quantum mechanics.

### 5. Example: Experimental Research in Physics is a Tautology of the Universal Law

The physical journal “Physikalische Blätter“ recently reported about the latest and exactest measurement of the rest mass of the proton and antiproton in CERN<sup>194</sup>. The conclusion from this experiment is that the opposite areas (charges) of the proton and the antiproton are equal with a precision in the order of  $10^9$ . As expected, the equation employed in this experiment is an application of the universal equation as a rule of three:

$$\frac{f_{c(\text{antiproton})}}{f_{c(\text{proton})}} = \frac{(m/q)_{\text{proton}}}{(m/q)_{\text{antiproton}}} = \frac{SP(A)_{\text{proton}}}{SP(A)_{\text{antiproton}}} = 1.0000000015 \quad (220),$$

<sup>194</sup> W. Quint, Das kälteste Antiproton der Welt, Phys. Bl., No. 10, 1996, p. 1005-1008, originally published in Phys. Rev. Lett. 74, 1995, p. 3544.

where  $f_c$  is the *cyclotron frequency* (see chapter 6.10, equation (148) and exercise 1.). This quantity assesses the time of the particle in the cyclotron. The above equation is based on an *a priori* assumption that the cross-sectional area (structural complexity) of the proton and the antiproton are equal:

$$q_{pr} = q_{anti-pr} = SP(A)[2d-space] = A^2 \approx \lambda_{c,pr}^2,$$

without giving any epistemological explanation for it. This assumption is experimentally confirmed in a secondary manner by using the geometric method of definition of the quantity charge (area) as a method of measurement. Both methods can be expressed by the universal equation for the quantity mass (space-time relationship):

$$m_{antiproton} \times f_{c(antiproton)} = m_{proton} \times f_{c(proton)} \quad (220a)$$

The actual result had the precision in the order of  $10^9$ . This result illuminates the fact that any abstract equivalence, which we build for the parts of space-time, is of transcendental character and can be arbitrarily approximated by using the continuum of real closed numbers.

With this knowledge, we can easily explain the vague, but very popular concept of **symmetries** in the physical world as represented in the **CPT-theorem** (C for *charge conjugation*, P for *space projection* and T for *time conversion*) of the standard model. This theorem, being a hidden definition of simple geometric and mathematical equivalences for the parts, postulates a **symmetry of barions**, that is, each particle and its antiparticle should have the same charge (cross-sectional area), mass (space-time relationship) and lifetime (time). The three quantities assess space, time and space-time of particles. The CPT-theorem is another variation of the concept of closed systems in the realm of mathematics - it is based on the idea of exact equivalence of space-time of particles and their corresponding antiparticles as given by the aforementioned abstract quantities.

This theorem is, however, limited by the principle assumption that these symmetries (= equivalences) can be violated under certain conditions (e.g. violation of the CP-symmetry in  $K^0$ -decay)<sup>195</sup>. The interpretation of CPT-violations has led to some obscure ideas that testimony the complete loss of common sense in modern physics. For instance, it is generally believed that a complete violation of CPT-symmetry will topple the edifice of modern physics - it will be a strong evidence for the existence of a fifth force which may interfere with gravitation and so on. These few examples should be sufficient to document the cognitive obscurity in current interpretation of CPT-violations and other aspects of quantum mechanics.

---

<sup>195</sup> W Schmidt-Parzefall, HERA-B - Ein neues Experiment bei DESY. Warum sich Materie und Antimaterie unterschiedlich verhalten. Phys. Bl., 53, No. 10, 1997, p. 319-322.

Let us repeat again: any equivalence that is built for any two subsets of space-time (quantities of the parts) is a definition by mathematical abstraction (H. Weyl); it reflects the principle of last equivalence for the parts. In this sense, any mathematical equation of physical quantities, which is an application of the universal equation, is a definition by abstraction, just as the CPT-symmetry of barions.

As all systems and levels of space-time are open and exchange energy, they are transcendental, that is, they always exhibit a CPT-violation. All exact equivalences as expressed by closed numbers or closed geometric figures are mathematical approximations of the infinite transcendence of the physical world. This also holds for any numerical result presented in this volume. This aspect has been thoroughly discussed in conjunction with gravitation in chapter 4.8.

## 6. Example: How to Calculate the Mass of Neutrinos?

As physics cannot explain the quantity mass, it has produced a number of paradoxical statements that will merit the attention of future scientists as valuable documents on the intellectual confusion of this empirical discipline during the twentieth century. One of them is the dispute over whether **neutrinos** have a rest mass or not. This has led to the conduct of some expensive experiments<sup>196</sup>. In addition, it is generally believed that the destiny of the standard model of modern cosmology is closely linked with this question: the existence of neutrinos with rest mass would inevitably lead to the rejection of this model. In section 9. we refute the standard model on the basis of the Universal Law. This example anticipates the results of the new cosmology.

It is a leitmotif of the present volume that mass does not exist as a real physical property. It is an abstract quantity defined within mathematics and thus an object of thought. In terms of mathematics, mass is a relationship of the space-time of real systems. The actual reference system of space-time is the basic photon. All other systems are compared to it according to the principle of circular argument, which is an application of the principle of last equivalence for the parts. This is the epistemological basis of the new axiomatics that also holds for neutrinos. According to it, neutrinos have a mass (energy relationship) because all systems have an energy. As all real systems are open, that is, they interact with other systems, their space-time can be measured (compared). The great problem of neutrinos' research is to detect an

---

<sup>196</sup> In June 1998, it was reported in the mass media that in an experiment performed in Hawaii, neutrinos were found to have a mass. This "sensational result" is a prospective, though superfluous, confirmation of the Universal Law and the new theory which proves that mass is a mathematical quantity - a relationship of the energy of two systems (axiom of reducibility) - so that every particle of space-time has a mass.

interaction of neutrinos with other particles of matter and measure it precisely - such interactions are quite rare and require specific conditions.

However, as all systems are open and interrelated (space-time is a prestabilized harmony), we can easily calculate the mass of neutrinos from quantum processes that involve these particles. We shall propose a simple method of calculating the mass of neutrinos from a **beta decay**. This phenomenon involves the elementary particles of matter and is quite common. As their energy can be precisely determined, we can, for instance, calculate the mass (energy relationship) of neutrinos from the space-time of the proton and the neutron. Before we shall discuss the method, we shall present a concise survey on the history of the discovery of neutrinos, as it is pathognomonic of modern physics.

The discovery of neutrinos is closely linked to the closed character of space-time, which manifests itself as a conservation of energy. This property of space-time is covered by the axiom of conservation of action potentials. It is important to observe that, although the conservation of energy is now unanimously accepted, there is still no theory that explains the conservation of energy from a cognitive point of view: "The theory of conservation of energy was based entirely on experimental observation. There existed no fundamental physical theory that *predicted* the conservation of total energy. Nor, in fact, does such a theory or equation exist now."<sup>197</sup> The ubiquitous phenomenon of energy conservation can be explained for the first time in the history of physics with the theory of the Universal Law that begins with the properties of space-time. As all systems of space-time are U-subsets that contain space-time (energy) as an element, they always manifest the properties of the whole, such as closed character (conservation of energy), continuousness, discrete-ness and openness. We shall show that these aspects of space-time are central to the discovery of neutrinos and the accompanying discussion.

At the turn of the 19th century, radioactivity of alpha, beta and gamma rays was discovered by *Becquerel*, *Rutherford* and others. This triggered the development of Bohr model (chapter 7.1). The *gamma rays* emitted during a nuclear decay were found to be **monoenergetic**. This energy interaction can be presented by a mathematical equation reflecting the principle of last equivalence:  $E_\gamma = E_i - E_f$ , where  $E_\gamma$  is the energy of the emitted gamma photons,  $E_i$  is the initial energy of the radioactive nucleus and  $E_f$  is the final energy of the nucleus after radiation. The same result holds true for *alpha decay*, as alpha rays have also been found to be monoenergetic. However, when a nuclear decay resulted in the emission of **beta rays** (electrons), it was found that they had a *continuous* energetic spectrum from zero, i.e., undetectable, to  $E_{max} = E_i - E_f$ . For the first time in the history of physics, an energy interaction did not allow the building of an exact mathematical equivalence:  $E_\beta \leq E_{max} = E_i - E_f$ , respectively,  $E_{final\ system} \leq E_{initial\ system}$ .

---

<sup>197</sup> RA Llewellyn, Discovery of neutrinos, Essay in PA Tipler, p. 218-220.

This result triggered a profound theoretical crisis in physics. Unfortunately, it did not lead to the discovery of the Universal Law and the development of a novel axiomatics based on the principles of mathematical formalism, but to a partial solution, which has satisfied the modest mathematical expectations of physicists in this field. In the new axiomatics we clearly state that space-time is transcendental, so that any physical equivalence which we build, except the last one, is a mathematical approximation defined by abstraction and is based on the application of closed, real numbers. Any real equivalence is, on the contrary, transcendental and of infinite order. This means that any energy exchange involves infinite levels and systems of space-time. Due to our modest technical means, we can only register few levels and particles of space-time. Exactly this knowledge has been transmitted by beta decay. When this energy exchange was discovered for the first time, it seemed to implicate the creation or annihilation of energy, thus violating the law of conservation of energy.

Initially, Bohr and the majority of physicists were inclined to discard the law of conservation of energy on the ground that a general law, which had been founded on experimental results (in fact, this law has never been founded on validated experiments because there are no closed systems of space-time that can be observed with respect to this property of space-time; see also quotation above), should be rejected if a further experiment failed to confirm it. **Pauli**, on the contrary, noted correctly that this would mean the discarding of all laws of energy conservation, which had been formulated in classical mechanics, for instance, the conservation of linear and angular momentum. If this should have been the case, it would have triggered the same *foundation crisis* in physics as the one observed in mathematics at the same time.

In 1930, Pauli suggested in a letter that the problem can be circumvented if the existence of a new particle should be postulated. It should have the following properties: 1) it should have no electric charge, that is, its cross-sectional area should be zero; 2) it should have a high ability to penetrate matter, that is, it should not interact with particles of matter; 3) its mass should be most probably zero, or nearly so, since beta rays with energies nearly equal (approximation) to  $E_{max}$  had been observed (recall that photons are still regarded as particles without charge (area) and mass).

If Bohr stands for the empirical dogma, Pauli stands for the priority of theoretical consciousness over empiricism. The reader may guess who has won at the end. However, this does not alter the fact that Pauli has been essentially wrong with respect to charge. In this case, he merely followed the central physical dogma based on complete agnosticism regarding the geometric nature of this quantity. To appreciate how radical Pauli's proposal was, one should bear in mind that at that time only two particles were known - the electron and the proton (see Bohr model). So to say, Pauli was the first to "invent" a new particle. Based on the new axiomatics, we are much more radical - we predict the existence of infinite systems and levels of space-time and thus abolish the standard model as *reductio ad absurdum*. In 1933, *J. Chadwick* discovered the

existence of neutrons. This encouraged *Fermi* to call Pauli's particle "neutrino", which means in Italian language "little neutral one". Finally in 1956, the neutrino - in fact, it was an anti-neutrino - was registered in a reactor at Savannah River.

Today, it is generally believed that there are six different kinds of neutrinos: the *electron neutrino*  $\nu_e$ , the *myon-neutrino*  $\nu_\mu$  and the *tauon-neutrino*  $\nu_\tau$ , and their corresponding antiparticles. The simplest **beta decay** associated with the occurrence of neutrinos is the decay of an unstable neutron in a proton and an electron:



During this nucleus decay a **surplus energy**  $E_s = 0.782 \text{ MeV}$  is observed. This energy is attributed to the electron-antineutrino(s). Normally, it would be sufficient to know the magnitude of this energy to determine the mass of the antineutrino. The problem is that this decay exhibits a continuous distribution of the kinetic energy of the emitted beta-particles (kinetic electrons) from nearly zero to the maximal available energy. For this reason, it is only possible to postulate an upper limit of the energy of antineutrinos. As these particles do not enter into energy interactions with other particles of matter, there is no possibility of determining their energy and mass in a direct way. These quantities can now be easily calculated from the known data of this beta decay by considering the mass  $m_p$  of the basic photon. We shall only present the general approach and leave the tedious calculation to professional physicists.

The energy distribution of beta rays can be presented as a curve that can be regarded as an aggregated action potential (U-set) of the underlying beta particles which exhibit continuous, but discrete kinetic energies. We can determine the **area under the curve, AUC** (area integral), and present this quantity in terms of the aggregated charge (area) of the kinetic electrons. Alternatively, the curve can be described in terms of statistics. It builds a peak that represents the maximum level of the emitted beta energy, that is, the maximum number of emitted electrons (electrons with the most frequent energy  $E_i$ ). When this energy is compared with the maximal kinetic energy  $E_m$  of the emitted electrons, its magnitude is about one third of the latter:  $E_i = E_m/3$ . Observe the same relationship  $R = C_m/3$  between the universal gas constant  $R$  in equation (72) and the molar heat capacity  $C_m$  of metals in equation (78) - both quantities are defined as thermodynamic energy. The maximal energy of beta rays is given in special tables for each decay. Thus we can easily calculate the total distribution energy of beta rays  $\sum E_e$  of any nucleus decay from known data, for instance, as AUC. This **total energy** can be expressed by the universal equation as a function of the mass of the basic photon  $m_p$ :

$$\sum E_e = \sum m_e c^2 = m_p c^2 \sum f_e \quad (222)$$

Equation (222) confirms the universal character of  $m_p$  which is a fundamental constant of the new axiomatics. The *aggregated time* of the beta rays  $\sum f_e$  is given in comparison to the *time* of the *electron at rest*  $f_e = f_{c,e} = 1$  (Compton frequency). If we depart from the neutron decay in equation (221), we obtain for the **energy** and **mass** of the **electron-antineutrinos** the following simple equations:

$$E_{anti-\nu} = E_n - (E_{pr} + \sum E_e). \quad (223)$$

$$m_{anti-\nu} = m_p (f_{c,n} - f_{c,pr} - \sum f_e). \quad (223a)$$

The only unknown variable in both equations is the sum (integral) of the frequency distribution  $\sum f_e$  of the emitted beta particles. This quantity gives the relativistic increase in the energy of the electrons during beta decay in comparison to their rest energy. When such calculations are performed, it may transpire that the antineutrinos exhibit a similar curve of continuous energy distribution as observed for beta rays.

In order to prove the validity of the above equations, we shall use them to calculate the **surplus energy**  $E_s$  and its **mass (energy relationship)**  $m_s$  from neutron beta decay (221): In this case, we have to only substitute the aggregated time of the beta rays  $\sum f_e$  with the Compton frequency of the electrons, which is the **intrinsic time** of this particle at rest (see chapter 7.1):

$$\begin{aligned} m_s &= m_p (f_{c,n} - f_{c,pr} - f_{c,e}) = \\ &= 0.737 \times 10^{-50} \text{ kg} \times 1.8934 \times 10^{20} = 1.395 \times 10^{-30} \text{ kg} \end{aligned} \quad (224)$$

$$\begin{aligned} E_s &= m_s c^2 = 1.395 \times 10^{-30} \text{ kg} \times 8.987 \times 10^{16} \text{ m}^2 \text{ s}^{-2} = \\ &= 1.253 \times 10^{-13} \text{ joule} = 0.782 \text{ MeV} \end{aligned} \quad (224a)$$

We obtain exactly the **surplus energy**  $E_s$  of the neutron decay given in equation (221). As we see, the only practical problem by the calculation of the neutrinos' mass is to determine exactly the total energy of the beta rays in any nucleus decay involving neutrinos. This should not be a major problem to modern experimental physics, which is applied mathematics. This is another **prospective test** for the validity of the new axiomatics and a proof for the obsolescence of fundamental experimental research.

**Table 2:** Axiomatics of basic physical quantities as derived from the primary term of space-time

Physical quantities	Conventional equations	Space-time-equations
Energy/space-time $E$ - Universal equation - Einstein's equation - Kinetic energy - Work etc.	$E = E_A f$ $E = mc^2$ $E = 1/2mv^2$ $E = Fs$	$SP(A)[1d\text{-space-time}][1d\text{-space}]f$ $=SP(A)[2d\text{-space-time}]$
Absolute time $f =$ Reciprocal time $1/t =$ Frequency, $f$	$f = \frac{E}{E_A} = \frac{1}{t}$	$f$
Velocity (speed), $v$ - Tangential velocity, $v$ - Angular frequency, $\omega$	$v = s/t = p/m = \text{etc.}$ $v = 2\pi r/T = uf = \text{etc.}$ $\omega = 2\pi f = kv = 2\pi/T = \text{etc.}$	$[1d\text{-space-time}]$
Conventional space quantities - Length=wavelength, $\pi$ - Area - Volume	$s, \lambda, \pi = u/d$ $s^2$ $s^3$	$[1d\text{-space}]$ $[2d\text{-space}]$ $[3d\text{-space}]$
Action potential, $E_A =$ Electric current, $I$	$E_A = \frac{E}{f} = K_s f = I = \frac{Q}{t}$	$SP(A)[2d\text{-space}]f =$ $=SP(A)[1d\text{-spacetime}][1d\text{-space}]$
Structural complexity as <i>area</i> Structural complexity as $SP(A)$ - Mass of basic photon, $m_p$ - Charge of basic photon, $q_p$	$K_s = E/t^2 = Q$ , when $f=1$ $K_s = E/E_R = E/c^2 = F/a = m$ $m_p = h/c^2 = h\mu_0\epsilon_0 = \text{etc.}$ $q_p = ef = \text{etc.}$	$K_s = SP(A)[2d\text{-space}]$ $K_s = SP(A)$
Energy as potential = $LRC$ - Square speed of light, $c^2$ - Electric potential/gradient - Gravitational potential	$LRC = E/q = E/m$ $U_U = c^2 = h/m_p = 8.987 \times 10^{16}$ $U_e = E/Q = q_0 E dl = \text{etc.}$ $U_G = E/m = gs = \text{etc.}$	$LRC = [2d\text{-space-time}]$
Force, $F$	$F = ma = E/s = \text{etc.}$	$SP(A)[1d\text{-space-time}]f$
Momentum $P$ , Impulse $I$	$p = mv = E/v = Ft = I = \text{etc.}$	$SP(A)[1d\text{-space-time}]$
Temperature, $T$	$T = 2K_{(ave)}/3k_b = PV/C = \text{etc.}$	$f$
Acceleration, $g, a$	$g, a = F/m = v/t = \text{etc.}$	$[1d\text{-space-time}]f$
Electric field, $E$ - Electric field of photons, $E_0$	$E = F/q = U/r = \text{grad}\phi = \text{etc.}$ $E_0 = 1/\epsilon_0 = 0.113 \times 10^{12} \text{ms}^{-2}$	$[1d\text{-space-time}]f$
Power, $P$	$P = dW/dt = Ef = E_A f = E_{neu}$	$SP(A)[2d\text{-space-time}]$
Angular momentum, $L$	$L = mvr$	$SP(A)[2d\text{-space}]f = E_A$
Density, $\rho$	$\rho = m/V = \text{etc.}$	$SP(A)[1d\text{-space}]$
Dipole, $p$	$p = ql$	$SP(A)[2d\text{-space}]$
Thermal resistance, $R_w$	$R_w = dx/kA$	$1/[2d\text{-space}] = 1/K_s$
Electric resistance, $R_e$	$R_e = U/I$	$f/SP(A) = f$ , when $SP(A) = 1$
Resistivity of materials, $\rho$	$\rho = RA/l$	$[1d\text{-space-time}]$
Electric flux, $\phi$	$\phi = EA = Es = E_A v = \text{etc.}$	$SP(A)[2d\text{-space-time}][1d\text{-space}]$
Magnetic flux, $\phi_m$	$\phi_m = BA$	$SP(A)[2d\text{-space}]f = E_A$
Magnetic field, $B$	$B = F/qv = E/E_A = \text{etc.}$	$f$
Magnetic moment, $m_m$	$m_m = (q/2m)L$	$SP(A)[2d\text{-space}]f = K_s$ , when $f = 1$
Total energy density of electro-magnetic waves (=Photon density) $\eta$	$\eta = E f(x)  =  \psi ^2 = \epsilon_0 E^2$	$SP(A)[1d\text{-space}] = f^2/[1d\text{-space}]$

## 8. SPACE-TIME CONCEPT OF PHYSICS

### 8.1 CLASSICAL MECHANICS

Like mathematics, physics has failed to define the primary concept of space-time in terms of knowledge. This principal flaw has been carried on in all subsequent ideas which this discipline has developed so far. The method of definition of space-time in physics is geometry. It begins with Euclidean space of classical mechanics. The substitution of real space-time with this abstract geometric space necessitated the introduction of two *a priori* assumptions on space and time by Newton that have not been seriously challenged since. Otherwise, we would not witness the parallel existence of classical mechanics and the theory of relativity. If Einstein's theory of relativity were a full revision of Newtonian mechanics, the latter would no longer exist. In the new axiomatics, we integrate all particular disciplines of physics into one consistent axiomatic system of physics and mathematics and thus eliminate them as separate areas of scientific knowledge.

There is no doubt that we cannot develop any scientific concept about the physical world without establishing a primary idea of space and time. Newton's primary notion of space and time is documented in his *Principles of Mathematics*<sup>198</sup>:

"Absolute Space, in its own nature, without regard to anything external, remains always similar and immovable. Relative Space is some movable dimension or measure of the absolute spaces; which our senses determine, by its position to bodies; and which is vulgarly taken for immovable space... And so instead of absolute places and motions, we use relative ones; and that without any inconvenience in common affairs; but in Philosophical disquisitions, we ought to abstract from our senses, and consider things themselves, distinct from what are only sensible measures of them. For it may be that there is nobody really at rest, to which the places and motions of others may be referred."

"Absolute, True, and Mathematical Time, of itself, and from its own nature flows equably without regard to anything external, and by another name is called Duration: Relative, Apparent, and Common Time is some sensible and external (whether accurate or unequable) measure of Duration by the means of motion, which is commonly used instead of True time; such as an Hour, a Day, a Month, a Year... All motions may be accelerated and retarded, but the True, or equably progress, of Absolute time is liable to no change."

---

<sup>198</sup> I. Newton, *Philosophiae Naturalis Principia Mathematica*; translated from Latin by A. Motte, London, 1729.

Thus Euclidean space is the abstract reference surrogate of „absolute space“ to which all other physical motions are compared by the method of geometry according to the principle of circular argument. It is the primary inertial reference frame of all reference frames, in which Newton’s *law of inertia* (1st law) holds true. This law is an abstract tautological statement within geometry and cannot be applied to any real reference system - for instance, to a gravitational system which is always in rotation (Kepler’s laws) and exhibits a centripetal acceleration. The reason for this is that Euclidean space has nothing to do with real space-time. Classical mechanics, which is based on this artificial space, contains no knowledge of the properties of space-time, as they are defined at the beginning of our axiomatics. According to Newton, space-time is “absolute, empty, inertial“, that is, free of forces, and can be expressed in terms of straight lines. These properties are summarized in his law of inertia postulating immobility (rest) or a straightforward motion (translation) with uniform velocity ( $a = 0$ ) for all objects, on which no force is exerted. In this geometric space „absolute time is liable to no change“:  $f = 1/t = \text{const.} = 1$ . In our axiomatics we have proven that geometric space can only be built after we have arrested time within mathematics in an a priori manner.

The law of inertia stays, however, in an apparent contradiction to the second and third law, and the law of gravity describing gravitational force as the origin of acceleration. While the first law is a mathematical fiction, the other laws of classical mechanics assess reality: there is no place in real space-time (universe), where no gravitational or other forces are exerted - for instance, we always observe rotations of celestial bodies (Kepler’s laws). As any rotation has an acceleration of  $a > 0$ , the law of inertia is not valid for rotations which are the only motions in space-time. This paradox of classical mechanics justifies Born’s estimation of Newton’s cardinal failure: “Here we have clearly a case in which the ideas of unanalysed consciousness are applied without reflection to the objective world.”<sup>199</sup> Since then, this remark can claim ubiquitous validity for the mind-set of all physicists.

The question is why physics sticks to the law of inertia if it is an apparently wrong and abstract idea without any physical correlate, for instance, why it has not been abolished by Einstein in his theory of relativity. The explanation of this default is given by Max Born again:

”In Newton’s view the occurrence of inertial forces in accelerated systems proves the existence of absolute space or, rather, the favoured position of inertial systems. Inertial forces may be seen particularly clearly in rotating systems of reference in the form of centrifugal forces. It was from them that Newton drew the main support for his doctrine of absolute space.”<sup>200</sup>

---

<sup>199</sup> M. Born, *Einstein’s Theory of Relativity*, Dover Publ., New York, 1965, p. 57-58.

<sup>200</sup> M. Born, p. 78

The basic paradigm behind the law of inertia is rather trivial: if a rotating body would move free of force in empty space, it would conserve its uniform tangential velocity expressed as straight line (vector) for ever. This property of the objects, called “**inertia**“, is regarded an *a priori* faculty that is inherent to matter. This idea immediately evokes another principal objection:

“The *law of inertia* (or persistence) is by no means as obvious as its simple expression might lead us to surmise. In our experience we do not know of bodies that are really withdrawn from all external influences: and, if we use our imaginations to picture how they travel in their solitary rectilinear paths with constant velocity through astronomic space, we are at once confronted with the **problem of the absolutely straight path in space absolutely at rest...**”<sup>201</sup>

Let us recall that the existence of straight parallel lines has not been proven in geometry. As space-time is closed, all subsets of it manifest this property and perform rotations, which can be described by closed geometric figures, such as a circumference (closed [*1d-space*]) or a spherical surface (closed [*2d-space*]). In addition, any rotation is a system of space-time that can be assessed in terms of force, acceleration (electric field), or any other abstract quantity of space-time. This is a basic statement of the new axiomatics which we have proved for all levels of space-time that have been described by physics so far. This fact is reflected in Lobachevsky’s geometry, which reduces Euclidean space to a partial geometric solution. From this analysis of the space-time concept of classical mechanics, we can conclude:

1. The introduction of Euclidean space for real space-time by Newton is the primary epistemological flaw of classical mechanics. The properties of this geometric space are: a) emptiness (no forces, no acceleration); b) homogeneity; c) the existence of straight paths (lines) d) absoluteness of space and time - no change of space and time magnitudes (immobility or translation).
2. These properties of Euclidean space are embodied in the law of inertia, which is an erroneous abstract idea without any real physical correlate. This law builds a basic antinomy with the other laws of mechanics, which assess real forces, accelerations and rotations.
3. While the absoluteness of space and time in classical mechanics is rejected by the theory of relativity, the homogeneity of space-time, which is tacitly accepted by the same theory, is refuted by quantum mechanics.

---

<sup>201</sup> M. Born, p. 29-30

4. However, these disciplines make no effort to define the properties of the primary term of space-time in terms of knowledge. For this reason, classical mechanics still exists as a separate discipline, although the basic antinomy appears in a disguised form in the initial-value problem (deterministic approach of classical mechanics) versus Heisenberg uncertainty principle of quantum mechanics (intuitive notion of the transcendence of space-time).

This line of argumentation will be followed in the next two chapters.

## 8.2 THE CONCEPT OF RELATIVITY IN ELECTROMAGNETISM

The partial correction and further development of Newtonian mechanics was done by Einstein - first, in the **special theory of relativity** and then in the **general theory of relativity**. The latter is the basis of modern cosmology. However, the origins of the theory of relativity were laid in electromagnetism and this concept is meaningless from an epistemological point of view without considering the concept of **ether**. The main achievements in electromagnetism (Maxwell, Lorentz) are based on the firm belief that ether exists and is another form of substance, which fills empty Euclidean space, that is, it should substitute empty space.

The further development of the ether concept, leading to its refutation, has furnished the two basic ideas of the theory of relativity: 1) Light has a constant finite velocity for all observers; 2) The ether, which has been regarded as an invisible elastic matter, substance, or continuum, where light is propagated, cannot fulfil the expectations attributed to the absolute, static Euclidean space of mechanics. Because of this, there is no possibility of proving the **principle of simultaneity** that has been considered valid in classical mechanics. Instead, it has been found that all phenomena appear to be **relative** for any observer with respect to space and time. It was Einstein's stroke of genius to realize the full importance of this simple fact. Before we proceed with Einstein's theory of relativity and explain why he failed to discover the "universal field equation", we must first discuss the precursors of the concept of relativity in electromagnetism.

From a cognitive point of view, electromagnetism has always been a **dualistic** theory. At the time when *Huygens* established the electromagnetic wave theory, Newton already supported the concept of particles. The dispute between these two opposite views was very stimulating and triggered the first measurements of the speed of light. As early as 1676, *Römer* was able to measure the speed of light from astronomic observations with an astounding degree of precision ( $c = 299\,793\text{ km/s}$ ). *Bradley* discovered in 1727 another effect of the finite speed of light, namely, that all fixed stars perform an annual rotation due to the revolution of the earth around the sun. Since *Foucault* (1865), we know that the speed of light in air is greater than its speed in any

other medium. This is the first confirmation of the maximal finite speed of light in “empty space“.

The major objective of electromagnetism, which evolved in the meantime into a separate discipline beside classical mechanics, was to find an explanation for the propagation of light in empty space as introduced by Newton in mechanics. If light were a transversal wave, as most experiments indicated, then it could only be propagated in an elastic medium, as the theory of optics preached at that time (*Fresnel*). These considerations led to the development of the **ether concept**.

This concept is of central theoretical importance, for it is a synonym for the primary term. We have shown in chapter 3.2 that the *General continuum law* is the differential form of the Universal Law in elastic medium, from which the classical wave equation (chapter 4.5), Maxwell’s four equations of electromagnetism (chapter 6.13) and Schrödinger’s wave equation of quantum mechanics (7.2) have been derived within mathematics. The ether concept was the most elaborated intuitive perception of the primary term prior to the discovery of the Universal Law. Its refutation on the basis of the **Michelson-Morley experiment** was a consequence of the failure of the ether concept to exclude all false properties attributed to the primary term since the introduction of Euclidean space in classical mechanics.

The Michelson-Morley experiment embodied the vicious circle of empirical agnosticism, to which physics had been subjected before the Universal Law was discovered. The projection of the properties of Euclidean space to ether led to the following cognitive outlook of electromagnetism: ether was a real, absolute reference system of material character analogous with absolute, abstract Euclidean space as introduced by Newton. Therefore, ether was defined as a static, that is, “**immovable**“ (Newton) elastic medium that filled the empty space of mechanics. In this medium, light was propagated with the speed of  $c$ . All other motions could be set in relation to this real immovable reference system of absolute character. The objective of the ether hypothesis was not only to provide a logical explanation for electromagnetism from a cognitive point of view, but also to eliminate the empty Euclidean space of classical mechanics. The aim of Michelson-Morley experiment was to prove this hypothesis. Before we discuss its results, we shall explain why this hypothesis, which was on the right track, must be refuted from a theoretical point of view.

The ether concept incorporates the dualistic view in optics and classical mechanics, whereby medium and waves are considered as two distinct entities (N-sets). This is the classical epistemological flaw one regularly encounters in conventional physics. For the first time in the new axiomatics, all real systems and levels of space-time are regarded as U-sets that contain themselves as an element. They can only be distinguished in the mind by means of mathematics, but not in real terms. This is a recurrent motif of the present volume. When we apply this fundamental axiomatic knowledge to ether, we must con-

clude that there is no possibility of distinguishing between motion as wave and medium. We have seen that the wave equation is derived by considering the rotation of the particles in the medium. In the new axiomatics, motion is a synonym for the primary term - the (elastic) continuum (principle of last equivalence). The definition of its basic quantity, velocity, is axiomatically derived from it as one-dimensional space-time within mathematics (point 21.). Therefore, we can write the following equivalence with respect to ether:

$$\begin{aligned} \text{ether as medium} &= \text{continuum} = \text{photon space-time} = \\ &= c = c^2 = LRC = c^n = \text{cons.} \end{aligned} \quad (225)$$

This equation simplifies our understanding of the concept of ether and relativity to an extraordinary extent. It says that [*1d-space-time*] is constant for each level of space-time - the constant speed of light is a specific quantity of the constant photon space-time. However, constant space-time is in incessant motion - constancy of space-time and its motion do not exclude each other, but are equivalent, complimentary aspects of the primary term. Bearing this in mind, it is easy to understand why the result of the Michelson-Morley experiment has led to the refutation of the ether concept, embodying the cognitive flaws of Newtonian mechanics, and at the same time confirms the nature of space-time as defined in the new axiomatics.

The ether hypothesis tested by this experiment can be summarized as follows: if the ether were a real, immovable system of reference, the measurement of the speed of light in a moving (rotating) system, such as the earth, would give different magnitudes for  $c$ , depending on whether the light is moving with the earth's rotation or in the opposite direction. However, neither Michelson nor Morley could find any change of  $c$  with respect to the earth's rotation. This correct result on the constancy of space-time, as manifested by the velocity  $c$  of the photon level, has led to the wrong conclusion that the earth is "immovable with respect to ether". However, the earth itself is a rotating system - it revolves around its axis, around the sun and so on (superimposed rotation). Therefore, this gravitational system cannot be immovable in absolute terms. As the speed of light  $c$  remains constant, the same must hold for the ether. It cannot be an immovable entity - an absolute reference system at rest, as expected in terms of Euclidean space. Unfortunately, instead of rejecting the empty space of classical mechanics and modifying the ether concept, the consequence of the Michelson-Morley experiment was the **refutation of the ether**, that is, of **photon space-time**, as a real level and its substitution with the concept of the void (vacuum), where  $c$ -dependent "actions at a distance" are observed, which are mediated through hypothetical fields. This experimental interpretation marks one of the darkest periods of modern physics, pushing this discipline in entirely the wrong direction for almost a century, until the Universal Law was finally discovered.

The interpretation of the Michelson-Morley experiment led to the development of the special theory of relativity<sup>202</sup>. The rejection of ether has cemented the dogma that space-time is empty and homogeneous, where photons, being particles with the energy  $E=hf$ , propagate with the speed of light. The dogma that particles move in vacuum is based on the assumption that N-sets exist and is thus a chief epistemological flaw in physics. Departing from the nature of space-time, we exclude all scientific concepts which are N-sets. In this way we eliminate all paradoxes of science that culminate in the famous **continuum hypothesis** of mathematics.

The origins of the **theory of relativity** were laid in electromagnetism when it became obvious that space and time were two canonically conjugated constituents of space-time that behave reciprocally. This reciprocity is an aspect of the constancy of space-time as manifested by the parts: as  $[space-time] = cons. = 1$ , then  $[space] = 1/[time] = 1/f$ . This follows from the primary axiom. The actual reciprocity of space and time is vested in the observation that the quotient of electron area (charge) and mass  $e/m_e = SP(A)_e/SP(A)_m = 0 \leq SP(A) \leq 1$  is decreasing with growing velocity  $v=[1d-space-time]=E$ . Within the new axiomatics, this phenomenon can be immediately solved. As mass is a space-time relationship built in an abstract way when the energy (space-time) of a system, such as the electron, increases relativistically, its space-time relationship, that is, mass, will also increase with respect to the constant reference unit of  $1kg$ .

This phenomenon was interpreted somewhat clumsily by Lorentz who postulated that the spherical form of the electron flattened in the direction of its movement, so that the mass increased in terms of density. He considered FitzGerald's interpretation of the Michelson-Morley experiment - it suggested that the earth contracted in the direction of its revolution. This would have explained why Michelson and Morley did not find any difference in  $c$  depending on the earth's motion. In this experiment, the location of the observer was linked to the earth or rather he was part of the earth. For this reason the observer was not in a position to determine the relative contraction of the earth. If the observer had been placed outside the earth, that is, in photon space-time, he would have measured a relative contraction of the earth in the direction of rotation. FitzGerald proposed a **simple factor of proportionality**, with which this **length contraction** could be calculated:

---

<sup>202</sup> In fact, Einstein learned from Michelson-Morley experiment only after he had already established the special theory of relativity. The interpretation of the theory of relativity in terms of this experiment is a *posteriori* adaptation of historical facts with respect to chronology.

$$\begin{aligned}
\gamma^{-1} &= \sqrt{1 - \frac{v^2}{c^2}} = \sqrt{\frac{c^2 - v^2}{c^2}} = \sqrt{\frac{dLRC}{LRC_p}} = \sqrt{\frac{SP(A)_{relative}}{SP(A)_{reference}}} = \\
&= \frac{[1d - space - time]_{rel}}{[1d - space - time]_{ref}} = 0 \leq SP(A) \leq 1 \quad (226)
\end{aligned}$$

We call this factor the “**proportionality factor of Lorentz transformations**“, or simply the **Lorentz factor**, because it is basic to his relativistic presentation of space and time in electromagnetism. Equation (226) shows that:

The **Lorentz factor**  $\gamma^{-1}$  is an iterative mathematical presentation of **Kolmogoroff’s probability set** as defined according to the principle of circular argument within mathematics. The initial system of reference is photon space-time as expressed by the  $LRC = c^2$ , to which the **relativistic change** of space-time of the systems  $dLRC$  is set in relation.

Lorentz derived this factor from **FitzGerald’s length contraction** and applied it to **time dilation**. He is the first to speak of the “*local time*“ and “*local space*“ of objects that change in a relativistic manner in the direction of movement. In terms of the ether hypothesis, FitzGerald’s length contraction and Lorentz time dilation indicate that when space and time are measured in moving objects, they will have different magnitudes compared to those measured in relation to absolute immovable ether, that is, to the space-time magnitudes measured in relation to themselves from a static point of view (building of the certain event within mathematics). In this way, the relativity of space and time, which is objectively observed and assessed by the Lorentz factor, has given birth to the theory of relativity.

In this process, both the absolute unchangeable space of classical mechanics and the concept of ether in electromagnetism have been abolished. They have been substituted by a hermaphrodite concept of space-time in the theory of relativity which is generally accepted today. It combines the emptiness and homogeneity of Euclidean space as vacuum (void) with the reciprocal behaviour of its constituents as assessed by the Lorentz factor in the electromagnetic theory of relativity. Furthermore, the general theory of relativity postulates that this space-time is “bent“ (curved) by gravitation. There is, however, no explanation as to how this energy interaction is mediated in the void, or by the void, because neither classical mechanics, nor Einstein’s general theory of relativity, proposes any theory of gravitation. This fact demonstrates the provisional character of Einstein’s theory of relativity.

### 8.3 THE SPACE-TIME CONCEPT OF THE SPECIAL AND GENERAL THEORY OF RELATIVITY

In 1905, Einstein realized that Lorentz transformations were not artificial presentations of the local space and time of electromagnetic systems, but were fundamentally linked to our very understanding of space-time. While the **principle of relativity** as expressed by the Lorentz factor is still believed to be of purely theoretical character, the constant speed of light is a well-established fact. In the first step, Einstein refuted the **principle of simultaneity** inherited from classical mechanics and substituted it with the **principle of relative simultaneity**. This “new“ insight was a delayed discovery. Since Galilei, it took more than three centuries to realize this simple fact, although the relativity of space (position) and time has been a central theme of philosophy since antiquity. The principle of relativity is a consequence of the properties of space-time. As space-time is closed, we can arbitrarily select any system as a system of reference and compare any other system to it according to the principle of circular argument. This means that there is no absolute space and time, but only specific magnitudes (relationships) of the two constituents for each system and level. This is a consequence of the inhomogeneity (discreteness) of space-time. The principle of simultaneity reflects the open character of the systems of space-time as U-sets - any local interaction is part of the total energy exchange in the universe (= primary term). The principle of simultaneity is an intuitive notion that space-time is a unity. Therefore, it is not a coincidence that when Einstein discovered this principle in physics, all avantgarde movements in Europe were discovering the principle of “**simultanéité**“ in arts and poetry (see volume IV). Today, we speak of globalization and regard the earth as a village. Tomorrow, if we survive, we shall expand this feeling to the universe by implementing the theory of the Universal Law. This is the anticipated evolution of human consciousness, before it becomes an active part of the universal consciousness of space-time<sup>203</sup>.

---

<sup>203</sup> The comprehension and active implementation of the theory of the Universal Law is not only a highly intellectual act - it is decisively determined by the mediality of the individual. The latter depends exclusively on the age of the soul of each individuum. At present, human mediality is on the verge of an evolution jump, which will profoundly change human consciousness. However, only old souls, at the end of their incarnation cycle, will profit from this evolution jump, which represents a profound energetic transformation of the human individual. This process, which is now running at high speed, has no direct impact on the majority of young souls that populate the earth at present. It will only change their „weltanschauung“. I have dedicated a special book on this subject of human gnosis.

As we see, Einstein's principle of relative simultaneity, on which his special theory of relativity is based, is an intuitive notion of the primary term. The two postulates of this theory are well known. The first one is the principle of relativity which says that there is no preferential inertial reference frame: natural law(s) is (are) the same in all inertial systems. The second postulate concerns the principle of the constant speed of light. The speed of light in vacuum is constant in any inertial reference frame and does not depend on the movement of the object, or alternatively: each observer measures the same value for the speed of light in vacuum. This is the traditional presentation of Einstein's postulates, which we can find in numerous textbooks on physics and the theory of relativity.

It is, indeed, amazing that until now nobody has noticed the intrinsic paradox between the two postulates. This is a classic example of the cognitive blindness of modern physics with respect to its basic concepts. The paradox emerges from the use of the concept "inertial reference frame". This term is introduced in conjunction with the law of inertia. This law can only distinguish between a **uniform** motion ( $a = 0$ ) and a motion with **acceleration** ( $a > 0$ ). Per definition, all inertial reference frames should move uniformly or stay at rest otherwise the first law is not valid. Does this mean that the principle of relativity does not hold in accelerated systems? Obviously not, for exactly this contradiction ought to be eliminated by Einstein's second postulate. It says that the speed of light remains the same, independently of the movement of the observer. This postulate does not discriminate between a uniform motion and a motion with acceleration. From this, it is cogent that there is a fundamental paradox between the first and second postulate of the special theory of relativity. How can we avoid this paradox?

This paradox is actually eliminated in the general theory of relativity, which is based on the **principle of equivalence**: "a homogenous gravitational field is completely equivalent to a uniformly accelerated reference frame."<sup>204</sup> This principle acknowledges the simple fact that there are no real inertial reference frames. For this reason, in the special theory of relativity, Einstein substitutes the concept of the inertial reference frame which is an object of thought without a physical correlate with the real reference frames - the local gravitational potential  $LRC_G$ . For instance, the gravitation of the earth is such a real reference frame. It is equivalent to an accelerated system, for example, to a rocket with the same acceleration as  $g$ , but launched in the opposite direction. This is a frequent example, with which the principle of equivalence is explained in conventional textbooks on physics.

There are two major cognitive aspects of this principle that should be elaborated. Firstly, there are infinite real reference frames because there are infinite celestial objects in space-time with specific gravitational fields or potentials (LRC). Secondly, this principle holds only in motions with uniform

---

<sup>204</sup> PA Tipler, p. 1132

acceleration and does not consider motions with changing acceleration. In the latter case, the motion is regarded as consisting of infinite small segments of uniform acceleration. As we see, the infinity of real reference frames is basic to the principle of equivalence. It is an intuitive notion of the infinity of space-time. This is also evident from the name of this principle. Einstein's idea of equivalence reflects the principle of last equivalence of our axiomatics when applied to the parts as the principle of circular argument. Any definition of a mathematical equivalence is based on this principle. We come to an important conclusion:

The **principle of equivalence** of the general theory of relativity is an application of the principle of circular argument. It also consists of building equivalences and making comparisons. This is the only objective of this discipline.

Evidently, when the theory of relativity is taken to its logical end (which Einstein obviously failed to do), it leads to the rejection of the law of inertia. This is inevitable in the light of the new axiomatics. However, this law has a rational core that should be spelt out for the sake of objectivity. From a mathematical point of view, the first law is a special case (borderline case) of the second law:  $F = ma$ ; if  $a = 0$ , then the resultant force is zero  $F = 0$  and we have the condition of the first law. The law of inertia holds only in reference frames **free** of forces, that is, in empty space. However, there is no empty space - space-time is continuous. What is the epistemological background of this law in the light of the new axiomatics? Very simple! The Universal Law departs from the reciprocity of space and time, where space-time (energy) is proportional to time:  $E \approx f$ . If time approaches zero  $f \rightarrow 0$ , then space-time will also approach zero:  $E \approx f \rightarrow 0$ . In this case, space will approach infinity [*space*]  $\rightarrow \infty$ . This infinite space will be homogeneous because its discreteness is a function of time  $f$ :  $discreteness = f \rightarrow 0$ . The extent of such an abstract space can be formally presented by means of straight lines (paths) within geometry because the radius of this hypothetical rotation will be infinite:  $r \rightarrow \infty$ . Under these boundary conditions, space-time will acquire the properties attributed to empty Euclidean space, as they are embodied in the law of inertia. From this we conclude:

The **law of inertia** is a mathematical abstraction (object of thought) that describes the hypothetical boundary conditions of space-time:

$$\begin{aligned} &\text{when } E \approx f = \text{discreteness} \rightarrow 0, \text{ then} \\ &[\text{space}] \rightarrow \infty = \text{homogeneous, empty space} = \\ &= \text{Euclidean space (straight lines)} \end{aligned} \quad (227a)$$

The actual theory of relativity is an application of Lorentz transformations of electromagnetism, with which the space-time of all material objects is mathematically assessed, while at the same time photon space-time is regarded as an empty, homogeneous entity. This mathematical presentation of space-time and its abstract quantities, such as mass and momentum, is called “**relativistic**“. Hence the terms: **relativistic energy**, **relativistic mass** and **relativistic momentum**. These quantities are built within mathematics according to the principle of circular argument by selecting photon space-time as the initial reference frame. This is a leitmotif of the present volume. When **FitzGerald length contraction** and **Lorentz time dilution** are expressed within the theory of relativity, we immediately recognize that the **Lorentz factor** is another mathematical presentation (iteration) of Kolmogoroff’s probability set (equation (226)):

$$\frac{t_R}{t} = \frac{L}{L_R} = \gamma^{-1} = \sqrt{1 - \frac{v^2}{c^2}} = 0 \leq SP(A) \leq 1 \quad (228)$$

$$\begin{aligned} \text{when } v \rightarrow 0, & \text{ then } \gamma^{-1} \rightarrow 1, \\ \text{when } v \rightarrow c, & \text{ then } \gamma^{-1} \rightarrow 0 \end{aligned}$$

In equation (228),  $t_R$  is the **rest time** between two events (Note: all events are action potentials), also called “local“ or “own time“, that is measured in a system at rest;  $t$  is the **diluted time** measured in an accelerated reference system. Analogously,  $L_R$  is the length of a system at rest, and  $L$  is its **contracted length** under acceleration. The Lorentz factor  $\gamma^{-1}$  assesses the relativistic change of space and time, that is, of the space-time of the systems in motion. Recall that all systems are in incessant motion. This is also the basic conclusion of the theory of relativity, namely, that all objects are in relative motion. From equation (228), it becomes evident that:

the **Lorentz factor** gives the **physical probability space**:

$$\gamma^{-1} = 0 \leq SP(A) \leq 1 \quad (229)$$

This is a fundamental conclusion of the new axiomatics that rationalizes the theory of relativity to **applied statistics of space-time**. The probability set of all space-time events, being action potentials, is set in the Lorentz transformations in relation to the LRC of photon space-time:  $LRC_p = U_v = c^2 = [2d\text{-space-time}]$ . When we substitute conventional time  $t$  with time  $f = 1/t$  in equations (228) and (229), we obtain the universal equation as a rule of three (see equation (38-5)):

$$\frac{E_1}{E_2} = \frac{f_1}{f_2} = \frac{[1d - Raum]_{.2}}{[1d - Raum]_{.1}} = \frac{t_R}{t} = \frac{L}{L_R} = \gamma^{-1} = \sqrt{1 - \frac{v^2}{c^2}} = K_{1,2} = SP(A)$$

(230)

This is the whole theoretical background of Einstein's theory of relativity - be it special or general. It is a partial and inconsistent intuitive perception of the Universal Law within mathematics. After being revised, it is integrated into the new axiomatics. In this way we eliminate this discipline as a distinct area of physical knowledge. For this purpose we shall explain in the next chapter the two basic terms of the theory of relativity, *rest mass* and *relativistic mass*, in terms of the new axiomatics, as their wrong conventional interpretation is the main source of the cognitive malaise which afflicts physics today.

#### 8.4 REST MASS IS A SYNONYM FOR THE CERTAIN EVENT. RELATIVISTIC MASS IS A SYNONYM FOR KOLMOGOROFF'S PROBABILITY SET

By proving that mass is an energy relationship, we have shown that Einstein's equation postulating the equivalence between energy and mass is a tautological statement. This equivalence plays a central role in the theory of relativity and in physics today. While in classical mechanics mass is defined in a vicious circle as the property of the gravitational objects to resist acceleration, in the theory of relativity mass is regarded as being equivalent to matter, while the term energy is restricted to photon space-time. This is the epistemological background of Einstein's equation:  $E=mc^2$ , or  $m=E/c^2=E_x/LRC_p$ . According to the principle of circular argument, the energy of any object of matter  $E_x$  is compared to the energy of the reference system, in this case, to the level of photon space-time, and is given as an energy relationship  $m$ . This relationship can be regarded statically or with respect to the own motion of the object. In the first case, this quantity is defined as **rest mass**  $m_o$ , in the second case, as **relativistic mass**  $m_r$ . Within the theory of relativity, the two quantities are expressed by **Lorentz transformations**:

$$E = E_{kin} + m_o c^2 = \frac{m_o c^2}{\sqrt{1 - \frac{v^2}{c^2}}} = \gamma m_o c^2 = m_r c^2 \quad (231)$$

This is the equation of the **total relativistic energy**  $E$ , which is given as the sum of the *kinetic energy*  $E_{kin}$  and the *rest energy*  $E_o = m_o c^2$ . We use this equation because it includes the relationship between the **relativistic mass** and the **rest mass**:  $m_r = \gamma m_o$ . Equation (231) is the relativistic expression of Einstein's equation  $E = mc^2$ . It reveals that the quotient of *rest mass*  $m_o$  and *relativistic mass*  $m_r$  is another pleonastic presentation of the **physical probability set** within mathematics:

$$m_o/m_r = \gamma^{-1} = 0 \leq SP(A) \leq 1 \quad (232)$$

We encounter the principle of circular argument again - the theory of relativity can only define the quantity "relativistic mass of an object" in relation to "the mass of the same object at rest". Both quantities are abstract subsets of space-time that are built within mathematics. So is their quotient, the Lorentz factor - it represents the continuum, respectively, the probability set. When we compare the **rest mass** with itself, we obtain the **certain event**:

$$m_o/m_o = m_o = SP(A) = 1 \quad (232)$$

**Rest mass** and **relativistic mass** are thus abstract quantities of space-time (space-time relationships) that are built within mathematical formalism. *Rest mass* is the abstract intrinsic reference system of the observed relativistic mass (principle of circular argument). It symbolizes the **certain event**  $m_o = 1$ . *Relativistic mass* gives the *real* space-time of any system in motion. As all systems are in motion, we can only observe relativistic masses. The relativistic mass is defined in relation to rest mass (principle of circular argument). As mass is a space-time relationship, any relativistic mass of a system is greater than its rest mass:  $m_r > m_o$ . Their quotient represents the **physical probability set**:  $m_o/m_r = 0 \leq SP(A) \leq 1$ .

This equation is derived by the principle of circular argument and includes the entire cognitive background contained within the two basic terms of the theory of relativity, rest mass and relativistic mass, which has not been realized either by Einstein or by any other physicist after him. The theory of relativity could, indeed, be very simple once the right axiomatic approach is employed - the new axiomatics of the Universal Law.

## 9. COSMOLOGY

### 9.1 INTRODUCTION

While physics has evolved to become a study of particular levels and systems of space-time that are closely associated with human demands, one would expect that cosmology has been developed into a study of the primary term when the principle of last equivalence is considered. This is, however, not the case when one analyses the few acceptable textbooks on this discipline. The outstanding feature of modern cosmology is the lack of a clear-cut definition of its object of study - the universe, space-time, energy, or cosmos is described in a vicious circle in the same mechanistic and deterministic manner as are its systems and levels in physics. Similarly, cosmology has failed to develop an epistemological approach to space-time. Nevertheless, there is a subconscious pattern behind all cosmological concepts that constitutes an intuitive perception of the primary term. This is a consequence of the fact that human consciousness always abides by the Universal Law.

The objective of this short survey on modern cosmology is to reveal this aspect. As we cannot consider all heterogeneous schools and ideas of this discipline, we shall restrict ourselves to the **standard model**, which represents the mainstream of cosmological thinking today. Based on the Universal Law, we shall reject this model and debunk the present system of cosmology. The remaining mathematical facts will be integrated into the new axiomatics.

Modern cosmology is a new discipline. It began in the twenties when the general theory of relativity was being developed as a geometric study of empty space-time and applied to the universe as an ordered whole (Einstein, Lemaître, de Sitter, Friedmann etc.). Its core is the standard model, a collection of heterogeneous ideas which have been put together in a similar manner to that in the standard model of physics. Hence the same name as first suggested by Weinberg (1972). The standard model of cosmology is a **hot expanding world model** based on the following primary ideas:

1. The universe is **homogeneous** and **isotrop** on average, at any place, at any time. This is called the “**cosmological principle**“. This philosophical concept is basic to any cosmological approach. It is an application of the principle of last equivalence - the primary term is perceived in the same way by anybody, at any time, at any place. This allows the establishment of an objective axiomatics that leads to the unification of science - the latter being a metaphysical level of space-time. This is essentially an anthropocentric definition because for obvious reasons we have no idea of how other conscious beings (aliens) perceive the physical world. The cosmological principle, being a rudi-

mentary idea of the primary term, was first introduced by Milne (1935) and then further developed by Einstein as a variation of his principle of equivalence (chapter 8.3).

Einstein departs from the **Mach principle**. It postulates that the inertial reference frames adopted from classical mechanics should be regarded in relation to the distribution and motion of cosmic mass, that is, in relation to the actual space-time relationships<sup>205</sup>. Einstein generalizes Mach principle and applies it to the whole universe. This was an arbitrary decision (degree of mathematical freedom), since the local space-time relationships which we observe are heterogeneous and discrete. Indeed, the universe consists of clusters of galaxies separated by photon space-time which is empty of matter, as is confirmed by recent astronomic evaluations, for instance, by the Hubble telescope. Therefore, the cosmological principle, which postulates a homogeneous and isotropic universe, does not assess the real properties of space-time, but is an abstract equivalence that is built within mathematical formalism. This fact reveals the absurdity of Einstein's endeavour to exclude human consciousness from any scientific perception of the physical world<sup>206</sup>.

2. The universe expands according to **Hubble's law** with the **escape velocity  $v$**  of the galaxies, which is proportional to the distance  $dl$  of the observer from the galaxies:

---

<sup>205</sup> "Einstein adopted, as Mach's principle, the idea that inertial frames of reference are determined by the distribution and motion of the matter in the universe". P.J.E. Peeble, Principles of Physical Cosmology, Princeton University Press, New Jersey, 1993, p.11.

<sup>206</sup> Einstein believed that natural laws existed independently of human consciousness. The logical reversion of this belief is that consciousness does not follow natural laws - hence his pledge for the elimination of subjective human consciousness from science. This epistemological antinomy is inherent to modern scientific outlook. The role of consciousness in defining all scientific concepts in an abstract manner, which are confirmed in a secondary manner in the real world, is eliminated from current scientific considerations. Instead, empiricism is celebrated as the only source of knowledge. However, it still operates in an unpredictable manner at the subconscious level as human intuition. In the new axiomatics, we eliminate this artificial antinomy by proving that consciousness is a system (level) of space-time that obeys the Universal Law, just as any other system or level. All primary concepts which have been historically developed in science reflect more or less the Universal Law. Unfortunately, this intuitively correct perception is frequently lost at the alleged rational level of current human argumentation - be it scientific or trivial. This is particularly the case with all non-mathematical ideas of science. The hidden psychological force behind this rejection of the Universal Law at the rational level is the "angst (anguish) structure" of human beings, which is of rigid energetic character and determines their illogical thinking and behaviour to a great extent. I have elaborated this energetic aspect of human behaviour in a special book on esoteric gnosis based on the Universal Law.

$$dv = dl/dt = H_0 l = [1d\text{-space-time}] \quad (233),$$

Hubble's law is an application of the Universal Law for one-dimensional space-time (see point 21.).  $H_0$  is called the **Hubble constant**. It is reciprocal conventional time and thus a constant quantity of time:  $H_0 = f$ . The epistemological background of this constant is not known in cosmology. We shall prove that this specific magnitude gives the constant time of the visible universe:  $H_0 = f_{vis}$ . In astrophysics, the Hubble constant is roughly estimated from the intensity of selected galaxies. Its value varies from author to author from 50 km/s to 80 km/s per Mpc (*megaparsec*). Latest estimations tend towards the smaller value. The reciprocal of the Hubble constant  $1/H_0$  is called "**Hubble time**" and is thus an actual quantity of conventional time. It is regarded as the upper limit of the **age of the universe**  $A_U \leq 1/H_0$  when the gravitational forces between the galaxies are ignored. As the traditional cosmological units of space and time are highly confusing, we shall convert them into SI units. This will significantly simplify our further discussion. The cosmological unit of distance [1d-space] is 1 *Megaparsec* (1 *Mps*) =  $3.086 \times 10^{22} m$ . We obtain for the **Hubble time** (= **age of the universe**) the following conventionally estimated value:

$$A_U = 1/H_0 = 3.086 \times 10^{22} m / 5 \times 10^4 ms^{-1} = 6.17 \times 10^{17} s \quad (234)$$

This corresponds to an estimated age of the universe of **20 billion** years. According to the standard model, the present universe has a "finite" age that is determined by the big bang; this initial event is defined as a space-time singularity. This assumption is in apparent contradiction with the primary axiom of our axiomatics which says that the universe, that is, its space and time, is infinite. At present, the actual age of the "finite universe" is estimated to be about **10-15 billion** years, when the gravitational forces between the galaxies are theoretically considered. However, as the mass of these galaxies cannot be determined - more than 90% of the estimated mass of the universe is defined as "**dark matter**", which simply means that scientists do not know anything about it (see neutrinos' mass above) - these estimations are of highly speculative character. It is important to observe that all basic space and time magnitudes in cosmology, such as the Hubble constant, can only be roughly estimated. This fact shows that present cosmology is anything but an exact empirical science. As these quantities are basic to the standard model, fundamental paradoxes have emerged, depending on the values employed (see the mother-child paradox below). This is already a strong indication that the standard model is not validated at all.

From  $A_U$  one can easily obtain the **radius of the finite universe**  $R_U$  as postulated in the standard model. By Hubble's law, the actual magnitude of the second constituent of the universe is defined as the maximal distance that can

be observed, that is, the maximal distance which the light that is emitted from the remotest galaxies covers before it reaches the observer:

$$R_U = cA_U = 2.9979 \times 10^8 \text{ ms}^{-1} \times 6.17 \times 10^{17} \text{ s} = 1.85 \times 10^{26} \text{ m} \quad (235)$$

According to Hubble's law, both values are **natural constants**. While this fact confirms the constancy of space-time (universe) as manifested by its systems - in this case, by the **visible universe** - it is in apparent contradiction with the assumption that the universe "expands". Modern cosmology does not give any explanation of this obvious paradox between Hubble's law and the hypothesis of the expanding universe as put forward in the standard model. A major objective of this section is to prove that:

The two magnitudes,  $R_U$  and  $H_o = 1/A_U$ , are **universal cosmological constants** that assess the constant space-time of the **visible universe**. When modern cosmology speaks of the "universe", it means the space-time of the visible universe, which is a system (U-subset) of space-time. The visible universe is not identical with the primary term of space-time (energy, universe etc.). The primary term cannot be assessed in a quantitative way, but only in philosophical and meta-mathematical categories.

Thus the visible universe is a specific, concrete cosmological system of space-time. It determines the limits of human knowledge at present. Therefore the visible universe is the only possible object of study of cosmology. Like any other system, it has a **constant** space-time - it is a U-subset that manifests the properties of the whole. For this reason, its **space** ( $R_U$ ) and **time** ( $A = 1/H_o$ ) magnitudes are **natural constants**. As space-time is an open entity, we shall prove that these constants can be precisely calculated from known space-time constants which can be exactly measured in local experiments. In this way we shall eliminate the necessity of performing expensive research of doubtful quality in astrophysics. While proving that modern cosmology can only assess the constant visible universe, we shall refute the erroneous hypothesis of an expanding universe from an infinite small space of incredible mass density, called the "big bang". This state is believed to have existed about 15-20 billion years ago. According to this view, the universe has evolved from this "space singularity" to its present state by expansion which still persists.

3. The standard model describes this past and present expansion of the universe. This model is based on Hubble's law and the existence of the **cosmic background radiation (CBR)**. The latter is regarded as a remnant of the initial, extremely hot radiation of the big bang that has been adiabatically cooled down to the present temperature of 2.73 K. The theoretical basis of this hypothetical, hot expansion model is the theory of relativity, which is geomet-

ry applied to the visible universe and deals essentially with the level of gravitation (see Einstein's cosmological constant). Therefore, the method of definition and measurement in cosmology is mainly geometry (topology) of space. In addition, the statistical method is used. The standard model is highly limited to philosophical introspective, for instance, it forbids questions like: "Where does the universe expand? Where does the space which opens between the expanding galaxies comes from?", and so on. In other words, this model evades any questions that should trouble the mind of any sincere cosmologist and concerns a true knowledge of the universe.

The standard model cannot explain many facts that have been accumulated in the last few years. For instance, new measurements by the COBE telescope have confirmed that the CBR is not *isotropic* and *homogeneous* as postulated by the standard model, but exhibits a **local anisotropy**. These conflicting facts have necessitated further modifications of the standard model. The so called "inflation hypothesis" has been developed by *Guth* and *Linde* to overcome the problem of **CBR-anisotropy**, which is of major theoretical importance. However, this hypothesis is of such a speculative character that it cannot be verified by any means. It rather exposes cosmology as science fiction. For this reason the inflation hypothesis is not considered part of the standard model, but a complimentary conceptual contribution of provisional character. The standard model excludes alternative cosmological explanations, such as the **steady state-models** of Bondi (1960) or Dicke (1970). These models reflect more adequately the constant character of space-time. As these models do not represent the mainstream of cosmological dogma, they will not be discussed in this short survey on cosmology.

## 9.2 HUBBLE'S LAW IS AN APPLICATION OF THE UNIVERSAL LAW FOR THE VISIBLE UNIVERSE

Equation (233) in the previous chapter shows that Hubble's Law is an application of the new axiomatic definition of one-dimensional space-time. As the Hubble constant is a natural constant, the law assesses the constant space-time of the visible universe:  $dv = dl/dt = H_0 l_{max} = [1d\text{-space-time}] = \text{cons}$ . The proof is fairly simple. According to Hubble's law, the maximal escape velocity  $dv$  which a galaxy reaches before it emits a light signal to the observer is the speed of light  $dv \rightarrow c$ . As Hubble's law claims universal validity, it also holds for escape velocities that are greater than  $c$ . In this case, the light emitted by galaxies with  $dv > c$  will not reach the observer because the speed of light is smaller than their opposite escape velocity. The resultant speed (space-time) of the emitted photons is negative with respect to the observer, that is, such photons will never reach the observer. As our information on any material celestial object in the universe is transmitted through photon space-time, galaxies with a higher escape velocity than the speed of light are no

longer visible to the observer. This means that there is an **event horizon**, beyond which Hubble's law still holds true, but can no longer be observed. The validity of Hubble's law beyond the event horizon also follows from the fact that it is an application of the Universal Law of space-time, while the visible universe is a particular system thereof.

The event horizon determines the boundaries of the visible universe with respect to human cognition. The boundaries of the visible universe are determined by the magnitude of  $c$  because photon space-time is the ultimate level of space-time which we can perceive at present. As all levels of space-time are U-subsets and contain themselves as an element, we cannot exclude the possibility that there are further levels beyond photon space-time with a higher velocity than  $c$ . If we gain access to them, we shall enlarge our event horizon of the visible universe. As we see, the event horizon assesses the space of the visible universe with respect to our senses and present level of technological development. This cosmological system can be expressed as [1d-space]-quantity, for instance, as radius  $R_U$  (open straight line), circumference  $S_U$  (closed line), or  $K_s = SP(A)[2d-space] = \text{spherical area} = \text{charge}$ , in geometry (method of definition = method of measurement). As in all other systems, these quantities are constant: they assess the constant space of the visible universe with the constant time of  $H_o$ . We conclude:

**Hubble's law** assesses the *constant* space-time of the **visible universe**:

$$dv = dl/dt = H_o l_{max} = H_o R_U \rightarrow c = [1d-space-time]_{vis} = \text{constant} \quad (236)$$

The maximal distance from the observer  $l_{max}$  is defined as the **radius of the visible universe**:  $l_{max} = R_U$  (equation (235)). In cosmology, one usually speaks of the "universe". Whenever we use this term from now on, we shall mean the "visible universe", which is a system of space-time and is thus not identical with the primary term. From the radius of the universe, we can easily obtain the **event horizon** of this basic cosmological system as  $K_s$  within geometry:

$$\text{Event horizon} = K_s = SP(A)[2d-space] = 4\pi R_U^2 = \text{constant} \quad (237)$$

This quantity is constant for any observer in space-time. This practical equivalence is an aspect of the cosmological principle. In this case, the cosmological principle is a U-subset of the principle of last equivalence for the system "visible universe" - it is an application of the principle of circular argument and is thus not identical with the primary axiom. This clarification is essential for the subsequent refutation of the standard model as hot expanding hypothesis.

### 9.3 FROM NEWTON'S LAW TO THE VISIBLE UNIVERSE (ND)

As modern cosmology is based on the general theory of relativity, it departs from gravitation to explain the geometry of the universe. The common quantities of classical mechanics, mass and density, are usually used to describe the universe. Purely for this reason, they have a central role in any conventional disquisition on cosmology. As Newton's law of gravity is considered to be of universal character, it is basic to any cosmological model, including the standard model. We have shown that this key law of classical mechanics is an application of the Universal law for the level of gravitation. It assesses the vertical energy exchange between matter and photon space-time. Photon space-time, in which all celestial bodies of matter are embedded, determines the extent (space) of the visible universe as assessed by Hubble's law. Thus the law of gravity can be applied to the visible universe or to any other subset of space-time.

We shall now implement the novel universal equation of Newton's law of gravity  $E = (c^3/G)f$  as given in equation (28) and the universal action potential  $E_{AU} = 4.038 \times 10^{35} \text{ kg/s}$  of the vertical energy exchange between matter and photon space-time from equation (30) - the latter quantity is a new fundamental cosmological constant which we have derived for the first time within the new axiomatics - and shall calculate the **mass** (space-time relationship) of the **visible universe**. For this purpose we shall use the following estimated values from the literature: radius  $R_U = 1.85 \times 10^{26} \text{ m}$  (eq. (235)) and **critical density of the universe**  $\rho_o = SP(A) / [1d\text{-space}] = 1 \times 10^{-26} \text{ kg/m}^3$  (equation (47)). The critical density is theoretically estimated from **Friedmann's model** that gives three possible solutions (see below).<sup>207</sup> When we apply the geometric method, we can consider the visible universe as a sphere with the **volume**  $V_U$  of:

$$V_U = \frac{4\pi R_U^3}{3} = 26.52 \times 10^{78} \text{ m}^3 \quad (238)$$

The **mass** of the **visible universe**  $M_U$  is then:

$$M_U = V_U \rho_o = 26.52 \times 10^{52} \text{ kg} \quad (239)$$

Alternatively, we can apply the universal equation of Newton's law of gravity (equation (28)) to calculate the mass of the visible universe. It says that any second  $f=1$  the mass (energy) of  $E_{AU} = E$  is exchanged between matter and photon space-time and vice versa. Through this energy exchange gravitation is mediated. We can now set for the time of the "visible universe" its age  $f_{vis} = A_U = 1/H_o = 6.17 \times 10^{17} \text{ s/1s}$  as calculated from Hubble's Law (eq. 234). In this

<sup>207</sup> R. & H. Sexl, Weiße Zwerge - Schwarze Löcher, chapter 9.6, p. 121-126.

case, we express the age as a dimensionless quotient. When we put this time magnitude  $f_{vis} = 6.17 \times 10^{17}$  in the new equation of Newton's law of gravity  $E = (c^3/G)f_{vis}$ , we can calculate the mass (energy relationship) "created since the big bang" if we adopt the conventional chronological view. This calculation departs from the standard model that postulates a finite universe. We assume that in any second after the big bang the universe expands with the space-time of  $E_{AU}$  given as energy relationship (mass) to the arbitrary SI unit 1kg:

$$M_U = E_{AU} H_o^{-1} = E_{AU} A_U = 4.038 \times 10^{35} \text{ kg s}^{-1} \times 6.17 \times 10^{17} \text{ s} = 24.9 \times 10^{52} \text{ kg} \quad (240)$$

We obtain for the mass of the visible universe almost the same result as calculated by the conventional geometric method in equation (239). This confirms the transitivity of mathematics and geometry when the Universal Law is applied. However, equation (240) does not prove that the big bang has occurred or that the universe expands. It simply illustrates that we do not need the standard model to explain and assess the vertical energy exchange between photon space-time and matter. If we apply the universal equation as a "law of gravity", we can calculate the mass (energy relationship) of the visible universe with respect to the experimentally observed *space*  $R_U = [1d\text{-space}]$  and *time*  $A_U = f_{vis}$  of this system without knowing the **critical density** of the universe.

The magnitude of this fundamental quantity, as calculated in cosmology today, is of highly speculative character, as more than 90% of the mass in the universe cannot be experimentally determined and is conveniently regarded as "dark matter". The density of the universe that is measured in astrophysics at present is about **10 times smaller** than the theoretically calculated *critical density*. This is the chief shortcoming of all contemporary cosmological models, the outcome of which depends entirely on the exact calculation of the critical density of the universe. This inherent shortcoming is now eliminated in an elegant manner. When we depart from the knowledge that mass and density are abstract mathematical U-subsets of space-time, the problem of "dark matter" disappears as an artefact that is born in the cosmologist's mind (mathematics as a trap in human thinking).

The critical density is theoretically estimated in **Friedmann's model** (or in any other model of the universe). It allows three geometric solutions of **Friedmann's equation**, which is an application of the universal equation (we leave the proof as an exercise for the reader), depending on the theoretically estimated critical density: 1) spherical, closed universe; 2) Euclidean, infinite universe; 3) hyperbolic, infinite universe. These are abstract solutions within mathematical formalism that approximate real space-time. Friedman's model does not specify which solution is correct. Based on the above example, we confirm that the theoretically estimated critical density of about  $1 \times 10^{-26} \text{ kg/m}^3$  assesses the actual space-time of the universe quite well. The result from equation (239) is almost equal to the result from equation (240). Friedman's

equation solves a **spherical closed universe** (1st solution) for the critical density. This result merely confirms that some early cosmologists intuitively employed the Universal Law to estimate the space-time of the visible universe from known natural constants with an astounding degree of precision and have thus proven that space-time as a closed unity.

In the above calculation, we take the value of  $R_U=1.85\times 10^{26} m$  (235) as determined from the lowest possible magnitude of the Hubble constant  $H_{ow}=50 km/s$  per  $MPs$  (equation (234)). This constant time of the visible universe  $f_{ives} = H_{ow}$  cannot be exactly determined by the conventional method in astrophysics that is based on the measurement of the intensities of selected galaxies. This method presupposes many *a priori* assumptions and approximations that are of highly speculative character and cannot be validated by any means. This explains the broad range of  $H_{ow}$ -values in the literature.

The inability of modern cosmology to determine the precise value of the Hubble constant is generally acknowledged as the central problem of this discipline. We shall now solve this problem conclusively. At the same time we shall demonstrate that space-time is an entity of open subsets, so that we can depart from any magnitude of space-time which can be exactly measured in a local experiment and obtain any other cosmological constant by applying the universal equation as a rule of three. For this purpose we shall depart from Newton's law of gravity. We have shown in chapter 3.7 that we can obtain a new formula of the universal gravitational constant  $G=c^2/S_U$  (equation (33)), where  $S_U$  is the **circumference** of the **event horizon** of the visible universe:

$$S_U = c^2 / G = [1d-space] = 13.46934 \times 10^{26} m \quad (241)$$

From the circumference, we can obtain the **exact radius**  $R_U$  of the **visible universe** as open  $[1d-space]$ -quantity within geometry:

$$R_U = \frac{S_U}{2\pi} = \frac{c^2}{2\pi G} = 2.14371 \times 10^{26} m \quad (241a)$$

As we see, the magnitude of the radius of the visible universe has been estimated fairly well in traditional cosmology when the lowest predicted value of the Hubble constant is considered (see equation (235)). If we now take the exact radius of the visible universe as measured in (241a), we can precisely calculate the **exact** value of the **Hubble constant** and solve the cardinal problem of modern cosmology:

$$H_o = \frac{c}{R_U} = \frac{2\pi G}{c} = 13.984735 \times 10^{-19} s^{-1} = 43.1568 Km/s \text{ per } MPs \quad (241b)$$

This calculated value of the Hubble constant is the most exact value that can be obtained at present within the approximate limits of the continuum of clo-

sed, real numbers. This basic cosmological constant is obtained as a quotient of two other natural constants,  $c$  and  $G$ , which can be precisely measured in a local experiment. It is important to observe that the Hubble constant is a mathematical quantity defined within geometry and has no real existence. The value in equation (241b) is somewhat lower than the lowest estimated value for  $H_o$  at present, but it confirms the current tendency in cosmology. The higher values which one finds for this constant in the literature are obtained when the gravitational forces are considered from a theoretical point of view. The weak point of this theoretical approach is that the gravitational forces between the galaxies are not known, as the mass of the universe cannot be determined. Such calculations are based on pure speculation and have no real value. As we have obtained the Hubble constant from the universal equation of Newton's law of gravity, the gravitational level is already considered in our calculation in equation (241b). The space-time of the universal gravitational level is expressed by the gravitational constant  $G$ . In addition, we do not need the mass (space-time relationship) of the visible universe, although we can easily obtain it from other known magnitudes. Equation (241b) is an application of the universal equation as a rule of three. From this equation, we can exactly determine the **age** (conventional time) of the **visible universe**:

$$A_U = 1/H_o = 7.15065 \times 10^{17} s \quad (241c)$$

This quantity has been estimated fairly well in equation (234) on the basis of the Hubble constant. It is a modest consolation that modern cosmology is not that bad when it operates as applied mathematics. This conclusion is, however, not surprising - we have stressed on many occasions throughout this volume that mathematics is the only adequate perception of space-time. At present, this basic cosmological constant is empirically determined on the basis of the density of remote galaxies that are separated by immense distances with no visible matter. Therefore, the precision of measurement of  $H_o$  is still not as good as that of the basic physical constants, such as  $c$  and  $G$ , which can be exactly determined in a local experiment. As space-time is a closed entity, we need only two exact values, preferably a space and a time magnitude of a selected photon system, e.g. the basic photon, to calculate any other magnitude (constant) of space-time without performing extensive and expensive experiments. This conclusion has been intuitively anticipated in the definition and method of measurement of the SI units, *meter* and *second*.

This elaboration eliminates both the unproductive dispute in cosmology about the exact value of  $H_o$  (comprising a large portion of the scientific activities in this discipline) and the necessity of performing superfluous, expensive astrophysical experiments. This example clearly demonstrates the superiority of the new axiomatics over the traditional empirical approach in physics and cosmology. It is an adequate introduction to the cosmological outlook of traditional physics. This will be the topic of our next chapter.

#### 9.4 THE COSMOLOGICAL OUTLOOK OF TRADITIONAL PHYSICS IN THE LIGHT OF THE UNIVERSAL LAW

The **hot expanding hypothesis** of the standard model assumes that the universe, as observed today, has evolved from a state of homogeneous energy with a negligible space and incredible density which exploded in a small fraction of a second. This initial state of the universe is described as the “**big bang**“. Since then, the visible universe - recall that cosmologists can only perceive the visible universe - is believed to have been expanding incessantly. In the context of this cosmological outlook, Hubble’s law is interpreted as a “law of expansion“. As this law is an application of the universal equation, we must reject this cosmological interpretation on axiomatic grounds. We have shown that Hubble’s law assesses the constant space-time of the visible universe (equation (236)). The two natural constants,  $R_U$  and  $1/H_o=A_U = f_{vis}$ , give the constant space and time of the visible universe (equations (241a) to (241c)) and confirm this conclusion. In this way we eliminate the first basic pillar of the standard model - the interpretation of Hubble’s law as a law of universal expansion. We shall now present additional proofs for this irrefutable conclusion.

The idea of the expanding universe is a consequence of the idea of homogeneous space-time in the theory of relativity. We have shown that Einstein has not completely corrected the empty Euclidean space of classical mechanics, but has only introduced the reciprocity of space and time for the systems of matter. Einstein regards the gravitational objects as embedded in empty and massless photon space-time defined as vacuum. With respect to the reciprocity of space and time, he assumes in the general theory of relativity that vacuum can be curved or bent by local gravitation. The current interpretation is that the path of light is attracted by local gravitational potentials and for this reason cannot be a straight line in space. When this space-time concept is applied to cosmology, it inevitably leads to the neglect of the **finite lifetimes** of stars, as they have been described by *Chandrasekhar* and have been only later verified in modern astrophysics.

The finite lifetime of any gravitational system is a consequence of the energy exchange between matter and photon space-time. The new axiomatics clearly states that all systems, being superimposed rotations, have a finite lifetime which is only determined by the conditions of destructive interference. During this vertical energy exchange, the space-time of the material levels, such as atomic level, electron level, thermodynamic level etc., is transformed into the space-time of the photon level and vice versa. Photons have a much greater extent than the space of material levels, as can be demonstrated by the [*1d-space*]-quantities of their elementary action potentials: the Compton wavelengths of the electron,  $\lambda_{c,e}=2.4 \times 10^{-12}m$ , the proton,  $\lambda_{c,pr}=1.32 \times 10^{-15}m$ , and

the neutron,  $\lambda_{c,n}=1.32\times 10^{-15}m$  are much smaller than the wavelength of the elementary action potential of the photon level,  $\lambda_A = 3\times 10^8 m$ , or more precisely, in the order of their intrinsic time - the specific **Compton frequency**:

$$f_{c,e} = \lambda_A/\lambda_{c,e} = 3\times 10^8 m / 2.4263\times 10^{-12} m = 1.236\times 10^{20}$$

$$f_{c,pr} \approx f_{c,n} = \lambda_A/\lambda_{c,pr} = \lambda_A/\lambda_{c,n} = 3\times 10^8 m / 1.32\times 10^{-15} m = 2.27\times 10^{23}$$

The [*1d-space*]-quantity of the elementary action potential is a specific constant of the corresponding level. It assesses the specific space of the level. During vertical energy exchange between two levels, the extent of space-time changes discretely in specific constant quantitative leaps. These leaps can be assessed by building space and time relationships between the levels (the universal equation as a rule of three). Such constants are dimensionless numbers. In the new axiomatics, we call them “absolute constants of vertical energy exchange“ (see chapter 9.9). When we observe vertical energy exchange only in one direction, for instance, from matter to photon space-time, this process is perceived as an **explosive expansion** of space-time. This is precisely the current cosmological view. The thermonuclear explosion is a typical, albeit more trivial example of an energy exchange from the nuclear level towards the photon level also defined as radiation. This process is associated with an extreme space expansion described as a “**nuclear wave**“. The reason for this is the extremely small extent of the hadrons compared to the extent of the emitted photons during explosion, as has been demonstrated by the corresponding time magnitudes of these systems of space-time - the Compton frequencies.

When this vertical energy exchange is observed in the direction from photon space-time to matter, it manifests itself as a **contraction** of space. Black holes are a typical example of extreme space contraction and for that reason they are circumscribed as “space singularities“. Initially, black holes were believed to only “devour“ space and matter. However, this would be a violation of energy conservation. Later on, it has been proven (within mathematics, because black holes cannot be directly observed) that they emit gamma radiation at their event horizon and thus obey the axiom of conservation of action potentials, just like all other systems of space-time. This has eliminated the spectacular character of these celestial bodies. The mean frequency of gamma radiation of black holes  $f_H$  can be presented as a function of the intrinsic time of the material particles:

$$m_p f_H = m_p (f_{c,e} + f_{pr,e} + f_{n,e}) / 3 \quad (242)$$

The high temperature of black holes is another quantity of material time - of the time of the thermodynamic level of matter. In chapter 5.5, we have deri-

ved the new **CBR-constant** and have shown that the frequency of the maximal emitted radiation depends only on the temperature of the material body:  $f_{max} = K_{CBR} \times T$  (equation (82)). In the next chapter, we shall use this constant to reject the second pillar of the standard model - the traditional interpretation of the 3K-cosmic background radiation (CBR). The 3K-CBR is believed to be a remnant of the hot radiation of the big bang, which has resulted from the subsequent adiabatic expansion of the universe. This view is presented in the standard model and is closely associated with the erroneous interpretation of redshifts by Hubble's law.

From this elaboration, we conclude that when the vertical energy exchange is observed only one way, that is, from matter to photon space-time, it gives the impression of space expansion. When the energy exchange is considered unilaterally from photon space-time to matter, it gives the impression of space contraction. When both directions are taken into consideration, the total change of space time is zero:  $\Delta V_U = 0$ , or  $V_U = cons$ . Space-time remains constant. This is an axiomatic statement of the new theory. It could have been easily deduced from the conventional law of conservation of energy.

In present-day cosmology, photon space-time is regarded as a homogeneous empty void. For this reason this discipline considers the vertical energy exchange between matter and photon space-time only **one way**: from matter, which can be observed, to empty space, which has no structure and therefore cannot be directly perceived. This one-sided anthropocentric view (human beings are part of matter) automatically evokes the misleading impression that the universe expands in the void. As the finite lifetimes of stars are not considered in this outlook, modern cosmology has no adequate idea of the discrete, ubiquitous energy exchange between matter and photon space-time, unlike in the new axiomatics. In chapter 3.7, we have proved that when the axiom of reciprocal LRC is applied to the visible universe, this system of space-time can be described as a function of the LRC of the photon level and the gravitational level. The space of the visible universe given as  $S_U$  (the circumference of the event horizon  $K_s$  of the visible universe (241)) is proportional to the LRC of the photon level  $LRC_p = U_U = c^2$ , which stands for space expansion, and is inversely proportional to the LRC of gravitation as expressed by the gravitational constant  $G$  (field or acceleration), which stands for the contraction of space (equation 37a):

$$S_U = c^2/G$$

This simple formula is an application of the universal equation as a rule of three. It embodies the space-time behaviour of the visible universe according to the axiom of reducibility. It proves that its circumference is a constant [*1d-space*]-quantity because it is a quotient of two natural constants,  $c$  and  $G$ , assessing the two levels - photons and gravitation.

For obvious reasons, cosmology can only assess the space-time of the visible universe and is not in a position to obtain any experimental evidence beyond its event horizon. This is the privilege of the new axiomatics - it assesses the primary term epistemologically and not empirically (priority of axiomatization over empiricism). As we see, the new axiomatics affects an incredible simplification in our cosmological outlook, and rejects the idea of an expanding universe as a false unilateral perception of the energy exchange between matter and photon space-time. This idea has given birth to many paradoxes, which are closely associated with the interpretation of the Doppler effect within Hubble's law. This will be the topic of the next two chapters.

## 9.5 THE ROLE OF THE CBR-CONSTANT IN COSMOLOGY

As already mentioned, the "big bang" hypothesis of the standard model is based on two pillars: 1) the cosmic background radiation (CBR) and 2) the expansion of the universe as assessed by Hubble's law. If these pillars can be interpreted in a different way, for instance, by the Universal Law, then the standard model must be refuted. In the previous chapter, we have explained how the idea of an expanding universe has evolved in cosmology, namely, from the one-sided perception of the vertical energy exchange between matter and photon space-time. In this chapter, we shall discuss the interpretational flaws of CBR in modern cosmology.

The experimental confirmation of the CBR, as predicted by *Gamov* on the basis of Friedmann's model and coincidentally discovered by *Penzias* and *Wilson* in the sixties, has evoked the mistaken conviction among cosmologists that the theoretical assumptions of the standard model hold true. The key assumption of this model is that, from the very beginning, the universe has been dominated by extremely hot blackbody radiation (hot photon space-time) that has cooled down during the adiabatic expansion of the universe to the present temperature of about  $3K$  - hence the term  $3K$ -CBR. The prediction of  $3K$ -CBR on the basis of wrong assumptions and its subsequent discovery is a curiosity that will certainly enjoy an outstanding place in the future gallery of scientific blunders. The traditional interpretation of the CBR as a consequence of the expansion of the universe will be now rejected.

We have shown in chapter 5.5 that the **CBR-constant** which determines the relationship between the temperature of the material body and the frequency of the emitted photons  $f_{max} = K_{CBR}T$  (equation (82)) depends on the speed of light and the proportionality constant of Wien's displacement law:  $K_{CBR}=c/B$ . The constant  $B$  is one-dimensional space-time of a novel thermodynamic level of matter that has not been realized so far (chapter 5.5, equation (81a)). In the view of traditional cosmology, the speed of light is a fundamental constant that remained unchanged during the big bang and in the first seconds of expansion of the universe. This assumption allows the determina-

tion of **Planck's parameters** of the “big bang“, which are basic quantities of the standard model (see chapter 9.7). Without the derivation of these parameters, the concept of the “big bang“ will be meaningless. According to the standard model, during the “big bang“ matter did not exist, at least, not in the form it is seen today. This would mean that  $B$  did not exist:  $B = 0$ , and  $K_{CBR}=c/0 = \textit{improbable event}$  (operation not allowed). On the other hand, the CBR-constant determines the frequency of any emitted photon radiation for any temperature of matter, which is, in fact, a time quantity of the thermodynamic level:  $f_{max} = K_{CBR}T$ . If we set for  $T$  the temperature of 2.73 K, we obtain exactly the **maximal frequency** of **CBR**, as is experimentally measured by **COBE satellite**<sup>208</sup>:

$$f_{max} = K_{CBR}T_{CBR} = 1.0345 \times 10^{11} \times 2.73 \text{ K} = 2.824 \times 10^{11} \quad (243)$$

If we assume that matter did not exist at the beginning of the universe, then we must also accept that there has been no thermodynamic level during the “big bang“ and the short time thereafter. Therefore, the time of this level, the temperature, should not have existed either:  $T = \textit{improbable event}$  (non-existent). In this case, we obtain for the time (frequency) of the photon space time:

$$\begin{aligned} f_{max} &= \textit{improbable event} (K_{CBR}) \times \textit{improbable event} (T) = \\ &= \textit{improbable event} \end{aligned} \quad (243a)$$

Equation (243a) symbolizes the entire nonsense of the standard model. If there has been no matter, there would have been no temperature and subsequently no photon space-time in terms of electromagnetic waves with the time (frequency) and velocity as observed today:  $c = f\lambda = 0\lambda = 0$ . The standard model postulates that  $c$  was valid during the “big bang“ (see derivation of Planck's parameters below). However, if there were no photon space-time, there would have been no radiation and thus no CBR as observed today. The assumptions of the standard model have not been challenged yet, only because the epistemological background of space-time, that is, of space and time, is not an object of interest in present-day physics and cosmology. This agnosticism is the origin of all the flaws in these sciences.

On the other hand, if we assume that the universe has evolved gradually by developing new levels, however, at time intervals that are infinite in relation to the estimated age of the universe, we can imagine similar conditions in black holes, neutron stars, quasars, pulsars and other similar material systems of gravitation (see chapter 9.9), as suggested for the “bang bang“ and the short period of time thereafter. In this case, we need not extrapolate in the past, as is

---

<sup>208</sup> COBE Science Working Group, Spectrum of the cosmic background radiation, in P.J.E. Peeble, Principles of Physical Cosmology, p. 132.

done in the standard model, but have to consider the finite lifetimes of stars in the context of the energy exchange between matter and photon space-time. When the energy exchange from matter to photon space-time is perceived unilaterally as expansion that is going on into the future, we inevitably come to the hypothesis of the “big bang“ when this process is traced back into the past. This false hypothesis follows from the idea that photon space-time is empty and homogeneous. This is the basic epistemological error of physics that engenders all the nonsense in cosmology.

The new axiomatics clearly says that the CBR-constant is an absolute constant of the vertical energy exchange between the thermodynamic (kinetic) level of matter and the thermodynamic level of photon space-time as assessed by Stankov’s law (chapter 5.7). Thus the time of the photon level depends on the time (temperature) of matter and vice versa: the temperature of matter depends on the frequency of the absorbed photons. This mutual interdependence can be observed any time in daily life, e.g. the warming of metals by sunbeams and their subsequent radiation as heat. The frequency of the sunbeam photons depends only on the surface temperature of the sun (equation (82)). Such phenomena are manifestations of the vertical energy exchange between matter and photons that takes place in both directions (conservation of action potentials).

Equation (243) holds for any temperature. Black holes and neutron stars are known to have extremely high temperatures. When the frequency of the photons emitted by these gravitational systems is calculated with this equation, we obtain a cosmic background radiation in the gamma range. Such high-frequency-CBR is regularly observed in astrophysics. Typically, this kind of CBR is not explained as a remnant of the big bang. This illustrates the ambiguity of current cosmological interpretations. Equation (243) is a very useful application of the Universal Law, with which we can determine the thermodynamic coefficients of vertical energy exchange of individual stars and other celestial bodies with photon space-time. In the next chapter, we shall show that the **redshifts** in the Doppler effect can be used in the same way to determine the vertical energy exchange between individual systems of gravitation and photon space-time. With respect to the theory of relativity, these absolute coefficients can also be called “relativistic coefficients of energy interaction“.

## 9.6 PITFALLS IN THE CONVENTIONAL INTERPRETATION OF REDSHIFTS

The method of measurement of *escape velocity* in Hubble's law is the determination of **redshifts** of selected galaxies. Hubble was the first astronomy to suggest a relationship between his application of the universal equation for the one-dimensional space-time of the visible universe (233) and the redshifts observed by the Doppler effect. In chapter 4.7 we have shown that the Doppler effect is a ubiquitous phenomenon that demonstrates the reciprocity of space and time. We have used this effect to explain the mechanism of gravitation in chapter 4.8. Redshifts in visible light are observed when the space of the photon system confined by the source and the observer expands; violet-shifts are observed when the space contracts. These changes of space are relativistic and occur simultaneously everywhere in the universe. For instance, one can observe both redshifts and violet-shifts of distant galaxies. Altogether, redshifts are predominant. This has led to the idea of using them as a method of measurement of the escape velocity of galaxies in an expanding universe. However, until now modern cosmology has not been in a position to present a theoretical proof that redshifts really measure the expansion of the universe, as is clearly stated in the following quotation<sup>209</sup>:

“The gravitational frequency and temperature shifts between observers are equivalent to the effects of a sequence of velocity shifts between a sequence of freely moving observers. For the same reason, the surface brightness of an object at a different (gravitational) potential would vary with its redshift... This is **not** a cosmology, however, for it is not known how one could get a reasonable redshift-distance relation from a stable static mass distribution, or what provision one would make for the *apparently finite lifetimes* of stars and galaxies... If the redshifts of quasars did not follow the redshift-distance relation observed for galaxies, it would show we have **mised** something very significant...

It is sensible and prudent that people **should continue to think about alternatives to the standard model, because the evidence is not at all abundant**... The moral is that the invention of a credible alternative to the standard cosmological model would require consultation of a considerable suite of evidence. It is equally essential that the standard model be **subject to scrutiny** at a still closer level **than the alternatives**, for it takes only one well established failure to rule out a model, but many successes to make a convincing case that a cosmology really is on the right track.”

---

<sup>209</sup> P.J.E. Peeble, Principles of Physical Cosmology, p. 226.

We shall now prove that **redshifts** measure the specific energy exchange of any gravitational system with photon space-time and therefore cannot be interpreted as evidence for the expansion of the universe. It is a well-established fact that redshifts are a classical test for the validity of the theory of relativity. They are appreciated as the most exact test of this theory. The magnitude of the redshift depends on the magnitude of the local gravitational potential ( $LRC_G$ ). In the general theory of relativity, the redshift  $df/f$  gives the (relativistic) change of the gravitational potential  $dU$  in relation to the LRC of photon space-time:  $df/f = dU/c^2$ . This relationship was first postulated by Einstein in 1911. Since then it has been empirically confirmed by numerous experiments with growing precision. The relativistic formula that is usually employed is an application of the universal equation as a rule of three:

$$\frac{df}{f} = \frac{dU}{c^2} = \frac{LRC_G}{LRC_p} = \frac{E_G}{E_p} = SP(A) \quad (244)$$

We shall use the same application in chapter 9.9 to establish the **derivation rule of absolute coefficients** of vertical energy exchange, with which we can build an **input-output model** of the universe based on dimensionless numbers (quotients). This input-output model is equivalent to the continuum of real numbers.

As already discussed, any relativistic presentation is a comparison of the actual space-time of a system with photon space-time (initial reference frame). In this particular case, the local gravitational potential of any celestial body, which, according to Einstein, is responsible for the local curvature of the empty homogeneous space-time, is compared to the constant LRC of photon space-time. From equation (244), we can obtain the so-called **Schwarzschild radius  $R_s$**  when we use Newton's law of gravity to determine the gravitational potential on the surface of a celestial body ( $R$  is the radius of a star, planet, or any other celestial body):

$$\frac{df}{f} = \frac{dU}{c^2} = \frac{GM}{Rc^2} = \frac{R_s}{2R} = SP(A) \quad (245)$$

This [*1d-space*]-quantity is obtained within geometry and is, in reality, a diameter and not a radius (imprecise terminology). The **Schwarzschild radius  $R_s$**  is of key importance to the theory of relativity, although this quantity cannot be explained in terms of knowledge. Traditionally, it is regarded as a measure for the relativistic effects of gravitational objects. In the light of the new axiomatics, this space quantity assesses the local absolute coefficients of vertical energy exchange of the individual gravitational systems, such as stars, planets, pulsars, quasars, neutron stars, black holes etc., with photon space-time. All gravitational systems undergo different states of material arrangement, such as white dwarfs, unstable stars, neutron stars, red giants etc., as

assessed by Chandrasekhar's equation of the boundary conditions of stellar transformation (finite lifetimes of stars). These stellar phases of specific space-time can be expressed by various quantities, such as mass, density, volume etc. and exhibit different coefficients of vertical energy exchange with photon space-time. From this, we can easily conclude that we can build infinite levels of gravitational objects with respect to their specific vertical coefficient. The local geometry (structural complexity) of the space-time of the visible universe can be precisely described with such local coefficients. This aspect will be further discussed in chapter 9.9. When equation (245) is derived from equation (37), we obtain the following simple application of the Universal Law for the **local space curvature**  $S_{local}$  as a function of the **local gravitation**  $g_{local}$ :

$$S_{local} = [1d-space] = c^2/g_{local} = \text{world line of local curvature} \quad (246)$$

This is the actual “**universal field equation**“ which Einstein was searching for in vain his whole life. It assesses the local curvature of photon space-time in terms of “world lines“  $S_{local}$  (Weltlinien der Krümmung des Weltalls). This [1d-space]-quantity is a function of the local gravitational potential, given as the gravitational acceleration or field of the celestial objects of matter. This is, in fact, the only objective of Einstein's general theory of relativity which is geometry applied to space-time. It could not succeed, not only because Einstein did not master the complexity of the mathematical instruments (Riemann's topology) which he intended to implement (it is a well-known fact that Einstein was a poor mathematician), but essentially because he did not explain the epistemological background of his theory of relativity. Let us now summarize the key knowledge to accrue from this elaboration:

The **redshifts** in the Doppler effect measure the **local vertical energy exchange** between the **individual gravitational systems** and **photon space-time**. According to the principle of circular argument, these energy interactions are presented relativistically, in comparison to the constant space-time of the photon level which is the universal reference frame. Therefore, redshifts should not be interpreted as evidence for the expansion of the universe.

The idea of an expanding universe based on redshifts has led to a number of fundamental paradoxes that expose modern cosmology as a system of fallacies. The first paradox is associated with the interpretation of black holes. According to the present view, these gravitational systems exhibit the maximal redshifts that are known at present. This is the current scientific opinion on this issue as expressed in the **uniqueness theorems** of black holes<sup>210</sup>, which are applications of the Universal Law within mathematics. If we now

---

<sup>210</sup> M Heusler, Black Hole Uniqueness Theorems, Cambridge University Press, 1996.

argue in the context of Hubble's law, we must assume that black holes are the remotest objects from any observer within the visible universe (cosmological principle). In this case, we must expect to find black holes only near the event horizon of our visible universe. The same holds true for quasars and pulsars, as they exhibit about 90% of the redshift-magnitude that has been determined for black holes. However, the experimental evidence in astrophysics does not confirm this conclusion which follows logically from the current interpretation of Hubble's law. In addition, this would be in breach of the cosmological principle which postulates an even distribution of celestial objects in the universe. This paradox should be sufficient to reject the standard model on present evidence. It is indeed a mystery why this has not already been done, even without knowing the Universal Law.

The absurdity of the present interpretation of redshifts as evidence for an expanding universe becomes obvious when we analyse the present cosmological view of the age and radius of the "finite" universe which is supposed to have emerged from the "big bang". The general belief is that the objects with the maximal redshifts are the remotest from the observer. As a consequence, they should be regarded as the oldest material objects in the universe, if we accept the "genesis" of the universe from the "big bang" as stated in the standard model. This is explained by the fact that the light that comes from such objects should need the longest time to cover the greatest distance before reaching the observer. In this case, this light should be of the oldest origin - it should have existed from the very beginning of the universe. The remotest objects that emit this light must have been very near to each other in this initial phase. As the universe is believed to have a finite age of about 15-20 billion years, this is considered to be the actual age of the light that comes from the remotest objects with the maximal redshifts. The paradoxical nature of this concept becomes evident when we apply the principle of circular argument of the new axiomatics as a **deductive method**.

Let us depart from the cosmological principle as an application of the principle of last equivalence for the system "visible universe". According to it, the above interpretation holds for any observer, at any place, at any time. Let us assume that we are the initial observer placed on the earth. We can now imagine at least one more observer who is situated between us and the remotest object with the maximal redshift. In this case the second observer will measure redshifts from objects that are beyond our event horizon. The redshifts of such objects cannot be observed from the earth. These objects will have a greater distance from the earth than the remotest objects we can observe from our planet. At the same time they will be older than the oldest objects in the universe, the age of which is set equal to the age of the universe. If we proceed with this deductive method, we can easily prove that there are objects in the universe that are infinitely remote from us and are thus infinitely old. It is important to observe that the same deductive method is used to define the term "infinity" in the theory of sets. This method departs from any number to define the infinity

of the continuum. In the new axiomatics, we define the infinity of the primary term in an *a priori* manner and then confirm this property in a secondary manner by the empirical verification of the phenomenology of the parts (U-subsets). We have used exactly this second method to prove that space-time is infinite, that is, eternal. This proof should be sufficient to reject the standard model that assumes a finite age of the universe. In fact, we can only measure the finite constant space-time of our visible universe as defined from the anthropocentric point of view of an earth's observer. However, according to the cosmological principle, there are infinite visible universes, as there are infinite potential observers in space-time.

The idea of the standard model that the universe is finite has led to another fundamental paradox, which has recently emerged from experimental evidence. The age of the universe is currently estimated by Hubble's law to be about 15 billion years. However, recent empirical data in astrophysics does not fit into this concept. Astrophysicists have established that there are stars that are **older** than the universe. This is now called the "**mother-child paradox**": the children (stars) are older than the mother (the universe). As we shall discuss below, the standard model postulates the emergence of stellar objects a long time after the occurrence of the "big bang". According to this model it is impossible for the stars to be older than the universe. It is cogent that this fact alone should be sufficient to reject the standard model postulating a finite universe. Again, we are tempted to ask why this has not been done before.

If we, instead, consider the finite lifetimes of stars as described by Chandrasekhar, we must conclude that we are **not allowed** to make any statements on the actual age of material systems, that is, of matter, based on the age of the emitted light that reaches the earth or a satellite launched from the earth. If stars periodically undergo different phases of material organisation, a fact that is beyond any doubt, how can we know their actual age if we can only determine the age of the light emitted during a certain phase of transition (see also quotation above)? For instance, when we register a light signal from a nova that is, let us say, seven billion years old, we can only say that seven billion years ago, that is, at a time when the earth did not exist, this particular star had this material configuration. As novae are **recurrent stars**, we cannot know their past or present states. For instance, there is no way of knowing how many transitions this nova has undergone in the past, that is, how old it really is. These arguments are based on common sense and are accessible even to the layman. This cannot be claimed for the arguments of modern cosmology<sup>211</sup>.

---

<sup>211</sup> In the last few years, there is a growing number of publications on cosmology that document the epistemological mess of this discipline. It is inutile to discuss them. We shall only mention a title of a recent book that is symbolic for this state-of-the-art: T. Ferris „The Whole Shebang, A State-of-the-Universe(s) Report“, Weidenfeld &

### 9.7 WHAT DO “PLANCK’S PARAMETERS OF THE BIG BANG“ REALLY MEAN (ND)?

When we extrapolate the hypothetical expansion of the universe in the past, we inevitably reach a point where the universe must be presented as a “space singularity“. This state of the universe is called “big bang“ in the standard model. In this space-less state, matter (energy) is believed to have been a homogeneous entity of extremely high density and temperature (see chapter 9.8). One postulates in an *a priori* manner that during this initial phase of universal genesis only three natural constants have remained unchanged: the *speed of light*  $c$ , the *gravitational constant*  $G$  and *Planck’s constant*  $h$  (the basic photon). Modern cosmology gives no explanation for this subjective preference.

We have already met a similar concept to the “big bang“ in classical mechanics - the mass point. While the mass point is an abstraction (object of thought) of real objects within geometry obtained by means of integration, the big bang is a mathematical abstraction of the whole. The prerequisite for this assumption is that space is empty and homogeneous. This error is introduced in cosmology through Einstein’s theory of relativity, but it goes back to Newton’s Euclidean space of classical mechanics, which Einstein failed to revise (see section 8.).

The standard model results from physics’ genetic failure to define the primary term from an epistemological point of view. Although the “big bang“ is an object of thought and never existed, cosmologists earnestly believe that they can mathematically describe this condition by the so-called „**Planck’s parameters**“. This name stems from Planck’s equation, which is used for the derivation of these quantities. The calculation of the hypothetical parameters of the “big bang“ is another outstanding flaw of cosmology of great didactic and historical value, comparable only to the medieval religious dogma postulating that the earth is flat and represents the centre of the universe. Before we discuss Planck’s parameters of the “big bang“, a few words on the history of the standard model.

If we define Einstein as the “grandfather“ of modern cosmology, we should look upon *de Sitter* as the father of this discipline. The “**Einstein-de Sitter universe**“ is the first mathematical model of the universe that is still considered an adequate introduction to this discipline. While “Einstein’s universe“ is static, but contains matter (space-time relationships), “de Sitter’s universe“ is dynamic, but completely empty. This is, at least, Eddington’s interpretation

---

Nicolson, London, 1997 (In this respect, it is quite amusing to observe how many cosmologists earnestly believe in the existence of many universes).

of these models. The “Einstein-de Sitter universe“ became famous because it implied the “big bang“ as the moment of genesis. The term “big bang“ was established only in 1950, when *Fred Boyle* mentioned it for the first time in a publication. The scientific penetration of this model began, however, ten years earlier and gained momentum in the sixties. The Russian scientist *Friedmann* was the first to introduce the idea of an expanding universe in his mathematical model (1922). Departing from the theory of relativity, he destroyed Einstein’s hopes of establishing a single irrevocable model of the universe. Instead, Friedmann presented three possible solutions (objects of thought), depending on the magnitude of the quantities (density) used (see chapter 9.3). As his work remained unnoticed during the Russian civil war, the Belgian priest *Lemaître* was the first to popularize this concept in the West.

The pre-war heritage of cosmological ideas in physics was further developed by *Gamov*, a student of Friedmann, under more favourable conditions after the war. He was the actual father of the standard model. The explosion of modern cosmology began in the seventies, and the diversity of conflicting ideas born in this period reached a state of inflation in the eighties. The nineties can be characterized as a period of prolonged stagnation that has been abruptly terminated by the discovery of the Universal Law. This is the short and not so glamorous history of this new physical discipline.

The three Planck’s parameters, which are believed to assess precisely the initial conditions of the universe, are: **Planck’s mass**, **Planck’s time** and **Planck’s length**. As we see, cosmologists have also recognized the simple fact that the only thing, they can do, is to measure the time, space, or space-time relationships of the systems - be they real or fictional. The theoretical approach to the “big bang parameters“ departs from Heisenberg uncertainty principle, that is, it departs from the basic photon  $h$ , as discussed at length in chapter 7.3. The basic photon with the mass  $m_p$  can be regarded as the **elementary momentum** of the universe:

$$p = m_p c = 2.21 \times 10^{-42} \text{ kgms}^{-1} \quad (247)$$

The *mass* of the basic photon is calculated by applying the axiom of conservation of action potentials, for instance, for its energy interaction with the electron as measured by the Compton-scattering:  $E_{A,e} = m_e c \lambda_{c,e} = h = m_p c \lambda_A$ ; hence:

$$m_p = h / c^2 = h / c \lambda_A \quad (248)$$

In cosmology, the axiom of conservation of action potentials is applied for the fictive interaction between the basic photon  $h$  and the hypothetical big bang, where the latter is regarded as another action potential:  $E_{A,big-bang} = m_{pl} c \lambda_c = h = m_p c \lambda_A$ . From this, the **Planck’s mass**  $m_{pl}$  of the big bang is determined according to equation (248):

$$m_{pl} = h/c\lambda_c = m_p c \lambda_A / c \lambda_c \quad (249)$$

Cosmology gives absolute no explanation as to why this equivalence has been chosen for the determination of the abstract quantity “Planck’s mass“. Therefore, equation (249) should be considered a subconscious, irrational application of the axiom of conservation of action potentials. The wavelength  $\lambda_c$  from equation (249) is defined as **Planck’s length** of the “big bang“:  $l_{pl} = \lambda_c = [1d\text{-space}]$ . For this reason we can also call it the “Compton wavelength“ of the “big bang“, analogously with the Compton wavelengths of the elementary particles. In the light of the new axiomatics, it is a one-dimensional space-quantity of the hypothetical space of the “big bang“:

$$l_{pl} = \lambda_c = [1d\text{-space}] \text{ of the hypothetical “big bang“} \quad (250)$$

The above equations demonstrate that the description of the space-time of the hypothetical “big bang“ departs intuitively from the correct notion of the Universal Law. It is the origin of all scientific ideas, whereas all basic ideas in science are of mathematical origin. However, the interpretation of such mathematical ideas at the rational level is full of logical flaws that vitiate all systems of science which have been developed so far.

Planck’s mass  $m_{pl}$  in equation (249) can be calculated only after *Planck’s length*  $\lambda_c$  of the “big bang“ is known. What is the traditional approach of modern cosmology to this problem? As expected, it departs from the *event horizon*  $l$  of the “big bang“ as the structural complexity  $K_s$  of this system. In this sense, **Planck’s length**  $l_{pl} = \lambda_c$  and the event horizon, expressed as radius, are set equivalent (definition within mathematical formalism):

$$l = l_{pl} = \lambda_c \quad (251)$$

The event horizon  $l$  of the “big bang“ is calculated by applying the same derivation of the universal equation as used for the Schwarzschild radius:  $R_s/2 = GM/c^2$  (see equation (245)):

$$l = Gm_{pl}/c^2 \quad (252)$$

In chapter 9.6, we have shown that this application of the universal equation assesses the absolute coefficients of the vertical energy exchange between individual gravitational systems of matter and photon space-time. In this sense, the “big bang“ is regarded as a hypothetical system of matter. This is in an apparent contradiction to the standard model which considers the “big bang“ as a state of condensed homogeneous radiation. According to this model, matter has evolved at a later stage. From the above equations, we can derive the **Planck’s length**:

$$l_{pl}^2 = \lambda_c^2 = Gh/c^3 \quad (253)$$

Some authors prefer to use  $h/2\pi$  instead of  $h$ . This is their degree of mathematical freedom. In this case, the value of the Planck's length is  $2\pi$  times smaller than in equation (253). The method of measurement of this space-quantity is irrelevant from a cognitive point of view as the "big bang" has never existed - it is a mathematical fiction, an object of thought, created by cosmologists.

Equation (253) contains the three natural constants,  $c$ ,  $G$ , and  $h$ , that have been postulated to hold in the "big bang". This is a vicious circle - it is a posterior adaptation (manipulation) of the physical world to comply with their mathematical derivation (after all, cosmologists have to perform some derivations and, to do this, they need certain natural constants.). This approach, defined as "fraud" in science, is not so seldom as is generally believed<sup>212</sup>.

The three constants assess the space-time of the photon level, which itself is determined by the space-time characteristics of gravitational matter. This basic proof for the closed character of space-time will be presented in chapter 9.9. We shall show below that the properties of photon space-time as assessed by the *magnetic field length*  $l_{\mu}$  (equation (110)) and the *electric acceleration or field*  $E_o$  (equation (109)) of photon space-time, from which the speed of light is obtained in Maxwell's equation  $c^2 = l_{\mu}E_o$  (105), depend on the average rotational characteristics of the gravitational systems in the universe, such as black holes, quasars, pulsars, neutron stars etc. This is a consequence of the vertical energy exchange between matter and photon space-time and a fundamental proof that space-time is a closed entity of open interacting U-subsets. According to the standard model, these gravitational systems were not developed in the initial phase of the universe. They have emerged at a much later stage, during the epoch of hadrons (see Table 9-1). This would mean that these celestial objects, which are believed to be a late product of the alleged genesis of the universe, have already determined the three natural constants,  $c$ ,  $G$ , and  $h$ , that existed in this form during the "big bang". This proof illustrates again the absurdity of the standard model. It is cogent that there is not a single statement of the standard model that is true. This model is, indeed, the greatest intellectual calamity in the history of physics.

Equation (253) can be solved for the universal gravitational potential:  $E_{AU} = c^3/G$  (equation (30)). When we set the reciprocal of this action potential  $1/E_{AU} = G/c^3$  in (253), we obtain for **Planck's length** the following remarkable equation:

---

<sup>212</sup> S. Lock & F. Wells, *Fraud and Misconduct in Medical Research*, BMJ Publishing Group, 1993, London.

$$l_{Pl} = \sqrt{\frac{Gh}{c^3}} = \sqrt{\frac{h}{E_{AU}}} = 4,05 \cdot 10^{-35} m \quad (254)$$

According to modern cosmology, Planck's length is the square root of the quotient of the two fundamental action potentials of space-time: the basic photon  $h$ , which is the smallest (elementary) action potential we know of, and the universal action potential  $E_{AU}$ , which is the aggregated product of all underlying action potentials with respect to the surrogate SI unit of time  $1 s^{-1}$ . We can derive from  $h$  the space-time of all elementary particles (see Table 1) and from  $E_{AU}$  - the space-time of the visible universe. Thus Planck's length is a quotient (relationship) of the [1d-space]-quantities of the smallest and the biggest action potential of the universe with respect to the SI unit 1 *second* (building of equivalence) according to principle of circular argument:

$$\begin{aligned} l_{Pl} &= \sqrt{\frac{h}{E_{AU}}} = \sqrt{\frac{SP(A)[2d - Raum]_h \cdot f_h}{SP(A)[2d - Raum]_{E_{AU}} f_{E_{AU}}}} = \\ &= \frac{SP(A)[1d - Raum]_h}{SP(A)[1d - Raum]_{E_{AU}}} = SP(A) \end{aligned} \quad (255)$$

In equation (255), the time of the basic photon is set equivalent to the time of the universal action potential per definition with respect to the SI system:  $f_h = f_{E_{AU}} = 1s^{-1} = SP(A) = 1 \text{ unit} = \text{certain event}$ . Equation (255) by no means confirms the existence of the "big bang", but simply illustrates the ubiquitous validity of the principle of circular argument as a method of definition and measurement of physical quantities. Indeed, it is impossible to perceive why the comparison of the smallest and the biggest action potential of space-time should be a proof for the existence of the "big bang". Both action potentials are products of constant space-time as observed today and none of them could have existed in the space-singularity of the big bang. This is cogent when the space magnitudes of the two potentials are compared with the magnitude of Planck's length of the hypothetical "big bang". We leave the proof of their incommensurability as an exercise for the reader.

The above derivations of Planck's parameters within the new axiomatics of the Universal Law illuminate the entire nonsense of the standard model. They explain the background of the epistemological flaws in cosmology. The universal action potential  $E_{AU}$  tells us that, every second, the mass (space-time relationship) of  $M = 4,038 \cdot 10^{35} kg$  is exchanged between matter and photon space-time. If photon space-time is regarded as empty, massless, homogeneous space or vacuum, as is done in cosmology today, then it is quite logical to neglect the energy exchange from photon space-time to matter and to

consider only the energy exchange from matter to photon space-time. This energy exchange is associated with space expansion. If at the same time, the finite lifetimes of stars are neglected, that is, their energy exchange with photon space-time, for instance, the transformation of space and matter into energy at the event horizon of black holes is not considered, the only possibility of explaining this fictional expansion is to assume that the universe has been subjected to an **adiabatic expansion** from its very beginning. However, it remains a mystery where the space that fills the gaps between the escaping galaxies comes from. Although this question is obvious in terms of common sense, it is not posed in modern physics. This is another typical example of the self-inflicted cognitive misery of modern cosmology.

The linear extrapolation of this hypothetical adiabatic expansion of the universe in the past ends inevitably with a space-less point, the “big bang” (the name is of no importance), where all known physical laws as determined today lose their validity. At least, this is what physicists make us believe at present. While this moment of “virtual genesis” may suit some popular religious beliefs, it has nothing to do with an objective science that should understand the object of its study.

Once Planck’s length is computed, one can quite easily determine any other quantity of the hypothetical “big bang”, because the universal equation is a rule of three. For instance, we obtain the following value for **Planck’s mass**:

$$m_{pl} = h/cl_{pl} \approx 5.5 \times 10^{-8} \text{ kg} \quad (256)$$

The same results is obtained when the mass  $m_p$  of the basic photon is used:

$$m_{pl} = m_p \lambda_A / l_{pl} = 0.737 \times 10^{-50} \text{ kg} \times 3 \times 10^8 \text{ ms}^{-1} / 4.05 \times 10^{-35} \text{ m} = 5.5 \times 10^{-8} \text{ kg} \quad (257)$$

Equation (257) demonstrates that the basic photon is the universal reference system of physics according to the principle of circular argument. From Planck’s length, one can easily obtain the hypothetical magnitude of the second constituent - **Planck’s time**  $t_{pl}$ :

$$t_{pl} = l_{pl}/c \approx 1,35.10^{-43} \text{ s} \quad (258)$$

According to modern cosmology, the three Planck’s parameters completely describe the “big bang”. It maintains that all physical laws have “lost their validity” in this hypothetical state, except the three constants,  $c$ ,  $G$ , and  $h$ , with the help of which Planck’s parameters of the “big bang” are computed. However, we have shown that all known natural constants and physical laws can be derived from each other, or more precisely, from the constants of photon space-time:  $c$ ,  $G$  and  $h$ . Therefore, we must conclude that all laws were

valid in the “big bang“. The only possible consequence of this conclusion is that **there has been no “big bang“** - this event has only occurred in the mathematical phantasy of cosmologists. What is the view of modern cosmology on this issue? If we try to learn more about this exotic, initial phase of the universe, we are consoled by such sibylline statements<sup>213</sup>:

“The relativistic space-time (of the big bang) is then no longer a continuum, and we even need a new theory of gravitation - of quantum gravitation or super-gravitation.“

Considering the fact that physics has no theory of gravitation, it sounds rather strange to demand a new theory of “quantum gravitation“ or “supergravitation“, whatever that means. Isn’t it much simpler to discard the standard model, as has been done in this section? In order to complete our analysis, we shall finally scrutinize the concept of adiabatic expansion of the universe as a complimentary aspect of the “big bang“-hypothesis.

## 9.9 ADIABATIC EXPANSION OF THE UNIVERSE

In our discussion of the Carnot cycle in chapter 5.6, we have pointed out that there is no such thing as “adiabatic expansion“. It is an abstract concept similar to the concept of potential energy in classical mechanics. As space and time are canonically conjugated, reciprocal magnitudes, any change in one constituent leads automatically to a change in the other. Adiabatic expansion contradicts the reciprocity of space and time. When the space of a system expands, time decreases and subsequently all space-time (energy) quantities which contain the quantity time in the numerator. Adiabatic expansion is based on the idea that the space of a system can expand, but that the pressure  $P = F/A = SP(A)[1d\text{-space-time}]f/[2d\text{-space}] = SP(A)f^2/[1d\text{-space}] = \sigma = \text{tensile stress}$  (equation (48)) remains constant. As pressure is a quantity of space-time that is proportional to time  $P \approx f^2 = 1/[space]$ , any expansion is associated with a reciprocal change in pressure. Adiabatic expansion is thus a mathematical idealisation.

In practice, the expansion of a system can occur with a minimal change in pressure at the material level when the net energy change is transformed into photon energy, for instance, by radiation. In this case, the change in space-time can no longer be observed in a direct way at the material level. This gives the impression of adiabatic expansion. While this concept may be useful in engineering, it is a completely erroneous idea when applied to the universe. The adiabatic expansion of the universe implies a net change in space-time and thus contradicts the law of conservation of energy, which is an aspect of

---

<sup>213</sup> PA Tipler, p. 1478, German ed.

the Universal Law and is confirmed by all physical phenomena. Thus the concept of adiabatic expansion of the universe, which is basic to the standard model, must be rejected on theoretical grounds. The source of this flaw is the unknown nature of the primary term - the reciprocity of space and time. However, this concept has a second aspect, which reveals that cosmologists have intuitively assessed the Universal Law for the visible universe, but, as usual, have interpreted it wrongly.

The standard model explains the adiabatic expansion of the universe with the Doppler effect in conjunction with CBR. During the “big bang“ and in the short period of time after this event, the universe is believed to have been extremely hot and the frequency of the initial photon radiation extremely high. This relationship between  $T$  and  $f$  is assessed by the new CBR-constant and is explained by the Universal Law (chapter 9.5). During the subsequent adiabatic expansion of the universe, the temperature and the wavelength of this radiation should have gradually decreased:  $f_{max} = K_{CBR}T$ . In terms of the Doppler effect, this adiabatic expansion has led to a global redshift of photon space-time, the magnitude of which has been growing from the past to the present and will continue to do so in the future. The present 3K-CBR should be regarded as the interim product of this process. Its temperature will continue to decrease in the future. This will inevitably lead to the “thermodynamic death“ of the universe. This is the conclusion of the second law of thermodynamics when it is applied to the growth of entropy in the universe. If, however, we assume that the universe may begin to contract sometime in the future, then we shall observe a global violet-shift of photon radiation. It is obvious that this assumption cannot be confirmed by any experiment.

According to this circular view, the adiabatic cooling of photon space-time that has led to the observed 3K-CBR is a remnant of the “big bang“. In the standard model, this adiabatic process is subdivided into several development phases of the universe. They are described in remarkable detail, as if they really have occurred and have been experimentally observed by cosmologists. In this respect, the standard model cannot be distinguished from science fiction. We shall not discuss these hypothetical phases. Instead, we shall concentrate on the hypothetical magnitudes of space and temperature (time), which the standard model specifies for these phases. They are summarized in Table 9-1 below:

Table 9-1: Development phases of the universe according to the standard model<sup>214</sup>

Epoch	Radius ( $R_U$ ) ( $m$ )	Temp. ( $T$ ) ( $K$ )	Space-time ( $v$ ) $v = R_U T =$ $= [1d-space] f =$ $= [1d-space-time]$ <i>cons.</i>
Epoch of stars	$10^{26}$	3	$10^{26}$
Epoch of radiation	$10^{23}$	$10^3$	$10^{26}$
Epoch of nuclear reactions	$10^{17}$	$10^9$	$10^{26}$
Epoch of hadrons	$10^{14}$	$10^{12}$	$10^{26}$

Table 9-1 gives the four hypothetical phases (epochs) in the development of the universe from the “big bang“ to the present state according to the standard model. They are defined with respect to the mean temperature and space (radius) of the universe for each epoch. We have shown that the temperature is a quantity of thermodynamic time (chapter 5.1). Thus the radius of the universe ( $[1d-space]$ ) and the temperature  $T$  (time) assess the magnitudes of the two constituents for each development phase of the universe. Their product gives the one-dimensional space-time of the universe. The last column in the table shows that this product is constant for each epoch:  $v=R_U T = [1d-space] f = [1d-space-time] = cons. \approx 10^{26}$ . We obtain the same result if we multiply the radius of the universe  $R_U$  (241a) with the 3K-temperature of CBR:  $v = R_U T_{CBR} = 2.14 \times 10^{26} \times 3 = 6.42 \times 10^{26}$ . This result illustrates that the adiabatic expansion of the universe is a subconscious, intuitive perception of the constant space-time of the visible universe, but erroneously interpreted at the rational level.

Finally, we should emphasize again that there is no temperature in the universe - this abstract quantity is an object of thought defined as a space relationship within mathematics and is thus a concrete quantity of time  $f$ . Time is a constituent of space-time. Space-time, itself, is termless, it is being, and human consciousness is part of being. The latter is a particular level of space-time with the propensity to reflect on space-time and itself. A concrete manifestation of consciousness is the development of science as a metaphysical and imperfect mirror image of space-time. The eschatological purpose of any scientific endeavour is the energy interaction of mankind with contiguous levels of space-time, such as physical matter, biological matter, photon space-

<sup>214</sup> Modified according to R. & H. Sexl, Weiße Zwerge-Schwarze Löcher, Table 10, p. 131.

time, human society, human products of consciousness etc. The objective of this manipulation of space-time by human species is to survive as a local material system of consciousness. As all local systems have a finite lifetime, the only possibility of surviving is to become an integral part of the universal consciousness. A prerequisite to this is that any human activity should adhere to the Universal Law. Only this way, is there a chance to achieve the appropriate level of human evolution that will qualify human beings to become a member of the trans-galactic club of consciousness. In the past, mankind has also evolved according to the Universal Law, however, in an unconscious and imperfect manner. This aspect is a central theme of volume IV and a separate book on human gnosis. The numerous infringements of the Universal Law in the history of mankind have regularly led to disasters. Especially in this century, history of mankind is rich in events that have pushed society on the verge of annihilation. This danger will not diminish in the future. Only when mankind begins to live according to the Universal Law, can it avoid its own extinction. There is not much time left to change the direction - we should not forget that time is a constituent of space-time that determines the prestabilized harmony of the universe. This is the ultimate message of the Universal Law, to which cosmology should also adhere.

#### 9.9 DERIVATION RULE OF ABSOLUTE CONSTANTS (ND)

The **derivation rule of absolute constants** of vertical and horizontal energy exchange is an application of the Universal Law as a rule of three. These constants are **dimensionless** space-time (energy) quotients that compare the space and time relationships of the various levels of space-time according to the principle of circular argument. The derivation rule is a **mathematical formalism** based on knowledge of the primary term. It makes use of the conventional applications of the universal equation, such as Newton's law of gravity, Coulomb's law, Planck's equation etc., which are built according to the axiom of reducibility. These derivations of the Universal Law assess the energy exchange between any two systems. As any energy interaction is an U-set, the mathematical presentation of such interactions implicitly involves vertical energy exchange. Any assessment of an energy interaction is a measurement of the constant space, time, or space-time relationships of the interacting systems with respect to a system of reference according to the principle of circular argument. Such constant relationships are traditionally presented as **natural constants** - all conventional laws include such constants. Normally, the constants are obtained by building relationships with the experimentally observed values, which are presented as **variable parameters**. Such relationships may pertain to a conventional physical law or an application thereof. The variable parameters are space and time magnitudes, or a combination of both. They are first defined within mathematics and only then measured in an

experiment, which always assesses a particular energy exchange. For instance, the distance between any two objects that exert gravitation or the duration of any energy interaction, e.g. a chemical reaction, can be voluntarily selected. In this way, the researcher is always an active part of the experiment - by determining the initial conditions of the experimental energetic interaction, he interferes in an *a priori* manner in the external physical world which he investigates. This inevitable, *a priori* energetic manipulation of nature in any experiment has been overlooked in present-day scientific empiricism. The idea of objective experimental research is therefore a pure fiction based on the intuitive notion that mathematics is the only method of definition and measurement of physical quantities because this discipline is the only adequate perception of space-time, that is, of the Universal Law. This will be illustrated by a historical experiment, which we shall present as a **scientific parable** below.

Imagine now a scientist who approaches nature empirically, as is preached in physics today, and not axiomatically, as is demanded in this volume. In this case, he will have to admit that he does not know anything about the “divine mysteries“ of nature, but ought to discover them step by step through tedious experimental research. In this belief, he follows the basic prejudice of empiricism which postulates that human mind has no knowledge of nature, but must acquire it through experience<sup>215</sup>. Although the overwhelming evidence in science, especially, in the history of scientific discoveries, discards this view, the **dogma of empiricism** is basic to modern scientific outlook and determines the psyche, intelligence and endeavour of twentieth century’s scientists<sup>216</sup>. They are conditioned (brain-washed) through their education and subsequent qualification to believe that, before they dare to discover a physi-

---

<sup>215</sup> This is the basic dogma of empiricism as documented by the following quotation of Locke: “Let us then suppose the mind to be, as we say, white paper, void of all characters, without any ideas; how comes it to be furnished? Whence comes it by that vast store, which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer in one word, from experience: in that all our knowledge is founded, and from that it ultimately derives itself.”

<sup>216</sup> For instance, all quarks, which were discovered in expensive cyclotron experiments in the nineties, were first defined theoretically. Their energetic characteristics were predicted by Murray Gell-Mann, the founder of quantum chromodynamics (QCD), in the early sixties on theoretical considerations, which he borrowed from the theory of quantum electrodynamics (QED) as developed immediately after the Second World War. The quark model, which is part of the standard model of physics, was confirmed much later in an experimental manner, mainly in CERN. This example illustrates that empiricism always follows theoretical knowledge, which is the initial event. From this example we must conclude that anything we learn about nature from experience is already known to human consciousness. The gnostic implications of this insight go far beyond the present discussion on physics.

cal law or a natural constant - in fact, the last physical law or natural constant were discovered more than 50 years ago when the empiric dogma was not so dominant -, they should investigate real phenomena experimentally till exhaustion.

As space-time has only two constituents, a scientist can practically only modulate the space and time magnitudes of the interaction(s) observed in an experiment. The two constituents are the only variables of any experimentally observed energetic interaction. All other quantities, which a scientist can select in an arbitrary manner as adequate variables of observation, are composed of the two constituents. They are introduced in the experiment by himself in an *a priori* manner through their method of definition and measurement. This fundamental fact has not been realized so far - for this reason we repeat it again and again.

Let us now take a gravitational interaction between two objects, which a scholar investigates for the first time from a scientific point of view. With respect to history, this man will be **Galileo Galilei**, who is the founder of modern physics. Let us assume that our scholar Galilei does not know anything about nature. Until then no physical law has been derived, even the concept of physical laws has not yet been developed. The founder of physics - the first, truly modern scientist in the history of mankind - the famous *signore* Galileo Galilei is an excellent mathematician and an ardent student of geometry of ancient Greece. His scientific background explains why he decides in an *a priori* manner to apply for the first time geometry as a method of measurement of **earth's attraction** of material objects. This force, called "gravita" or "gravitazione" is known since antiquity, but, before Galilei, nobody has ever made an effort to measure it precisely. Galilei decides to measure **earth's gravitation** - "la forza che attira i corpi verso il centro della Terra" - in a free fall and in inclined tubes, in which a ball is rolling downhill. For this purpose he chooses the famous **Pythagorean theorem**  $c^2 = a^2 + b^2$  as a method of definition and measurement of gravitation. In his experiment,  $c$  is the height of the free fall, which Galilei presents as the **hypotenuse** of a right triangle, while  $a$  and  $b$  are the paths of the *inclined* tubes, which he presents as the **sides** of the right triangle. For didactic purposes, Galilei designs this right triangle in a circle. The hypotenuse, that is, the height of the free fall, is presented as diameter of the circle, which is perpendicular to the earth, while the sides of the right triangle, which give the distances of the inclined tubes, are presented as **chords** of the circle, which subtend the ends of the diameter and join to a right angle. This *a priori* geometric presentation of a gravitational experiment allows Galilei to build infinite right triangles with the same hypotenuse (building of equivalence) and with sides (inclined tubes) of various lengths, which can be compared (building of [1d-space]-relationships).

Galilei's geometrically designed experiment on gravitation follows the principle of circular argument, which he introduces through the geometric method of definition of the space quantities - the hypotenuse and sides of the

right triangle, along which the fall of the ball is observed; at the same time, it is the method of their measurement. We have thus described the famous historical **experiment of Galilei on gravitation**, as presented in German Museum of Technique in Munich (1997). As we see, the first scientific experiment in the history of modern physics, which has ultimately led to the definition of the law of gravity, is based on the geometric method. Since Galilei, this is the basic method of definition and measurement of physical quantities in experimental research and theoretical physics.

However, geometry is a hermeneutic discipline of human consciousness and independent of empiric experience. It is part of mathematics, which is a system of objects of thought. Prior to the discovery of the Universal Law, this basic discipline of human knowledge could not prove its validity in the real world - the missing "proof of existence" has led to its famous foundation crisis. By establishing the new physical and mathematical axiomatics, I have ultimately furnished the proof of existence of mathematics: this discipline is the only adequate perception of the primary term and its U-subsets. In this way I have eliminated the foundation crisis of mathematics. At the same time, I have explained why nature behaves in a mathematical manner, that is, why all known physical laws are mathematical equations - they are applications of the Universal Law, and this law assesses the nature of space-time. This is a leitmotif of the present volume and a prerequisite for an understanding of the following parable.

Without employing geometry, Galilei's experiment on gravitation would have been meaningless - it could not have been reproduced and validated. Galilei's decision to assess gravitation in a free fall through the Pythagorean theorem has allowed Newton to present Galilei's results in a general mathematical equation, which is since then known as the "law of gravity". At this point, it is important to observe that Newton himself did not discover the three laws of mechanics and the law of gravity by experiments, but only presented Galilei's experimental results and Kepler's three laws, which were based on Galilei's experiments on gravitation and on additional astronomic data, within geometry by introducing Euclidean space as a universal reference frame. There is no doubt that Newton's achievement in physics could not have been possible without Galilei's experimental results on gravitation. The initial decision to use geometry in mechanics goes back to Galilei and not to Newton, who is only responsible for the cardinal flaw in physics: the substitution of real space-time with empty Euclidean space. This was not the initial intention of Galilei, as the following scientific parable will show. This retrospective re-evaluation of the merits of the three founders of modern physics, Galilei, Kepler and Newton, is very instructive, as it also reveals the gross aberrations in the current appreciation of basic historical achievements in physics.

Let us repeat it once more: without mathematics, any experimental research would be nonsense - for instance, all SI units are based on the

mathematical method. Any quantitative evaluation of energy interactions is only possible through mathematics, respectively, geometry. This demonstrates the priority of consciousness over empiricism. This elaboration should be sufficient to eliminate the dogma of empiricism in science and restrict its relevance to daily affairs. In order to underline this conclusion, we shall show that, with his gravitational experiment, **Galilei has actually discovered the Universal Law by using geometry**. The scientific parable below is, however, a realistic “experiment of thought“, and not just a thought without experimental verification, as are the „Gedanken-experiments“ initially introduced by Einstein in physics.

### **Galilei’s Famous Experiment of Gravitation Assesses the Universal Law with the Pythagorean Theorem**

Before Galilei starts with his experiment, he argues as follows: “The theorem of Pythagoras which I have used for the construction of this experiment says that:  $c^2 = a^2 + b^2$ . According to this equation, it does not make any difference if the ball is falling to the earth in a free fall along the perpendicular hypotenuse  $c$  or along the inclined path consisting of the sides  $(a+b)$ . If I define the work which my assistant does to carry the ball to the top of the triangle as “energy“ with respect to my favourite philosopher, *Heraclitus*, this would say that the energy of the falling ball will be the same, no matter which way it falls down to the same point on the earth. From the geometry of the triangle, I can assert that the energy (work) remains unchanged, **independently** of how the ball **moves** from one point to another. To prove this hypothesis, I must measure the falling times in  $a$ ,  $b$  and  $c$  and compare them. To ensure that I do not commit any mistake, I shall change each time the length of the inclined tubes and measure the falling times of the ball for various side lengths of  $a$  and  $b$  of the right triangle in the circle.

After the experiment, Galilei analyses the results *ad alta voce*: “My experiment on gravitation shows that the falling time, **tempo**  $t$ , of the ball, which I have chosen as a representative object of matter, **materia**  $m$ , is independent of the slope of the inclined tubes: the falling time for the hypotenuse  $c$  is equal to the falling times for any length of the inclined tubes  $a$  and  $b$ . Therefore I can write this practical result as follows:  $t_c = t_a = t_b = t = \text{constant}$ . In this case, I can use the famous Pythagorean theorem, which I have already employed for the construction of my experiment, to present the results in a simple mathematical equation. This method has recently become quite popular, after that French youngster *Descartes* and his followers, the *Cartesians*, are keen in explaining the world from the mind by employing the **geometric method** - they call it boisterously the “Cartesian method“. Why not! This maybe a good idea. As far as I remember, it was Descartes who wrote about the **conservation of movement** in the universe? This is exactly

what I have observed in my experiment on gravitation. Indeed, it would be “una buona idea“ to test if the theorem of the old grand master also holds for earth’s gravitation. If I am lucky to prove it, I will at same time present evidence that the **Aristotelian system of forms**, which is based on the **Pythagorean school**, also holds in gravitation. This will be an excellent confirmation of the validity of ancient Greek science in the spirit of Italian *rinascimento*. On the one hand, the system of Aristotle has not been challenged since antiquity; it is generally accepted among scholars and does not need any additional confirmation. On the other hand, I have read that most Greeks were contemptuous to experiments and did not border much about scientific experience - for them Geometry was the ultimate Truth. If I could now prove that Geometry holds for earth’s gravitation - this divine force of matter -, I will be the first scholar to show convincingly that Nature operates according to Geometry. Pythagoras teaches us that “everything is number“. Could it be that his theorem is also valid for the new **system of Copernicus**, as my intuition whispers me when I reflect on my recent astronomic observations of the planets’ movement? In this case I have to refute the **Ptolemaic system**, to which this god-damned church sticks without any grounds. Take care, old chap! The spies of the inquisition have flooded even the free town of Florence. You better solve this problem for yourself and keep it secret during your lifetime. Let future scientists re-discover the mechanism of gravitation and the motion of planets when life will be less dangerous than in our turbulent times. Let us now order the results of the experiment in a logical manner.

If the time  $t$  of the falling ball  $m$  is constant in any of the tubes  $a$ ,  $b$  and  $c$ , I can introduce the falling time  $t$  and the ball  $m$  as mathematical symbols in the Pythagorean theorem. For this purpose, I have to multiply the hypotenuse  $c$  and the sides of the right triangle  $a$  and  $b$  with the term  $m/t^2$ :  $c^2 = a^2 + b^2 \mid \times m/t^2$ . This artificial mathematical operation will not alter the initial validity of the famous theorem. On the contrary, it will bring a real physical meaning to this abstract theorem of Geometry - from now on, it will also hold in gravitation:

$$m \frac{c^2}{t^2} = m \frac{a^2}{t^2} + m \frac{b^2}{t^2} \quad (259)$$

This is a pretty good result, but my intuition tells me that I have to present this mathematical equation in a more adequate form. Let us try it now! The hypotenuse and the sides of the right triangle are **straight lines**. According to **Euclid**, they have only one dimension, which I can present as “1d“. I can express these straight paths with the symbol [1d-spazio] for one-dimensional space. The time  $t$  measures how “quick“ the movement of the falling ball is. As the ball needs the same time to fall in  $c$  as in each of the sides,  $a$  and  $b$ , of the right triangle, the movement of the ball is the “quickest“ during the free fall in the hypotenuse because  $c$  is longer than any of the sides,  $a$  or  $b$ . If I now build a quotient of space (**spazio**) and time (**tempo**), I will have an

adequate measure to compare how “quick“ the movement of the ball is. This is, indeed, a brilliant idea! As far as I know, nobody has come to this idea before. I will call this new mathematical quantity “**velocita**“ (velocity) and express it mathematically with the first letter of the word “**v**“: I can now write the following equation:

$$v = \text{velocita} = \frac{[1d - spazio]}{[tempo]} = \frac{[1d - space]}{t}$$

Not bad, but I am not satisfied with this presentation. Building quotients like this one takes a lot of place and paper is expensive nowadays. I can solve this practical problem by defining the reciprocal time  $1/t$  as **tempo fisico** (physical time) and use the first letter of the word “fisico“ as a mathematical symbol for

this quotient:  $f = \frac{1}{[tempo]} = \frac{1}{t}$ . Thus, **physical time**  $f$  can be easily distin-

guished from **(t)empo ordinario**  $t$  (conventional time). Now, I can write for the velocity:  $v = [1d-spazio] f$ , or simply  $v = [1d-spazio-tempo] = [1d-space-time]$ . I think this is a simple expression, which any educated man with a modest knowledge of mathematics will immediately understand. I shall now express the Pythagorean theorem with the new symbols, so that everybody can learn this **equation of gravitation** by heart without realizing that I have borrowed it from Pythagoras. This is a good method to hide my initial source of inspiration:

$$m \frac{c^2}{t^2} = m \frac{a^2}{t^2} + m \frac{b^2}{t^2} = m v_c^2 = m v_a^2 + m v_b^2 =$$

$$= m[2d-spazio-tempo]_c = m[2d-spazio-tempo]_a + m[2d-spazio-tempo]_b = \text{cons.}$$

(260)

Galilei contemplates for a long time before he speaks again: “If I am honest, it is unfair to hide the name of the greatest scholar of antiquity, to whom I owe my entire scientific knowledge. I must find an elegant solution of paying reverence to Pythagoras without going into troubles with the inquisition, which looks with a bad eye upon his Geometry.“ He thinks intensively: „Now, I got it! I will substitute the symbol for the ball  $m$  with a new symbol of abbreviation: “**SP(A)**“ for “il **S**upremo **P**ythagoras di **(A)**ntiquita“. I like this very much! Similarly, I will express the constant (e)nergy of the ball in a free fall  $mc^2/t^2$  with the first letter “**E**“ of the name of its first discoverer - “il grande filosofo di Efeso - **E**racliteo.“ In this way, I will pay tribute to the

two greatest philosophers of ancient Greece in my **General equation of gravitation**:

$$E = SP(A)[2d-spazio-tempo] = SP(A)[2d-space-time] = cons. \quad (261)$$

Strange! I have an awkward feeling that I have met this equation before. I am sure that it can't stem from another contemporaneous physicist. As there are only few physicists like me in Italy and North Europe, I am well acquainted with their works. Could it be that I have met this equation in the works of that wizard - an excellent mathematician and astrologist with an incredible virtue of prophecy - who had died in Salon-de-Provence only two years after I was born. What was his name? Ah, yes, I got it, they called him *Nostradamus*! I must have hidden his apocryphal books somewhere in my private library. I remember that I bought them from a beggar who knocked on my door some years ago. He was selling beautiful books written partly in Latin and partly in French. I had never seen such books before. I must find them and check their content again. He is searching in his library: "Ah, here they are! Let me see (he reads). What an ambiguous and secret language! Poor guy! His life must have been as insecure as mine. Yes, I have found what I am looking for. Nostradamus foretells the arrival of an unknown scholar of byzantine origin who will come to the West and will (re)discover the Universal Law of nature at the end of the second Millennium".

Galilei reads from Nostradamus' book: "After much "trial and error" in science, lasting for more than four centuries from now on, this man will unify science and will trigger a new renaissance of Greek Logic, similar to that we observe in arts and literature in Western Europe after the fall of Constantinople." Galilei murmurs: "What a coincidence! This man uses the same equation for Heraclitus' **primordial energy** (flux) as myself. Excellent! It was a very good idea to think of Nostradamus. One never knows where one's inspiration will come from." Galilei is excited. He turns the pages of Nostradamus' book forth and back: "Ah, what do I see? This byzantine scholar must have had some predecessors during *Novecento*. Their names are Lorentz, Einstein and some more, especially, Einstein is often mentioned by Nostradamus. But this is incredible! How is it possible that so many physicists are working on the same problem? This will never happen in Italy today. All these scholars are using geometric formulae to solve physical problems. Here, Nostradamus gives us an example." Galilei reads further with an expression of incredulity on his face: "Mamma mia! They also use the Pythagorean theorem, but what a complicated mathematical expression have they chosen! Vergogna! Now wait! How do they call this equation? - the **right triange theorem of the total relativistic energy in relation to momentum and rest energy**:

$$E^2 = (pc)^2 + (m_0c^2)^2 \quad (262)$$

Dio mio, this is my geometric theorem of gravitation - only written with other symbols! I must scrutinize it.“ He reads further: “Now, I see. These scholars depart from the equation of the relativistic energy (231) and the equation of

the *relativistic momentum*  $p = \frac{m_0 u}{\sqrt{1 - u^2 / c^2}}$ , which is obviously a mathe-

matical iteration of the above equation. What does the byzantine scholar say about this result? Yes, he is in accordance with me. He proves that the *equation of the relativistic energy* is an application of the universal equation of Heraclitus’s primordial fire as obtained by myself for gravitation. The same is also true for the *relativistic momentum*, which is a mathematical quantity of the primordial energy and has no real existence. That’s good! It seems that I am on the right track. This scholar shows that the above equations are mathematical abstractions that merely assess the “continuum of numbers or probabilities“. This expression is new to me. I only know of the continuum of geometry - Plato and Aristotle tell us about the ideal forms of the geometric continuum that assimilate real forms, but why not use the continuum of numbers for the same purpose. Most probably, both terms are identical. Anyway, it is a well-known fact that we can express any geometric solution in numbers and vice versa. Take for example the **irrational number**  $\sqrt{2}$ , which follows from the Pythagorean theorem. Plato says that this number symbolizes the incommensurability of the geometric continuum. Therefore the continuum of numbers expresses the continuum of Geometry with different symbols - we can replace any geometric symbol with a mathematical one and vice versa. This is exactly what I have done in my equation on gravitation.“

Galilei turns the pages hastily and reads at random. He is bewildered: “This is, indeed, a pure nonsense! Lorentz and Einstein, or whatever their names will be, assert that the aforementioned relativistic equations of the Pythagorean theorem prove that the velocities of the particles cannot be greater than the speed of light because otherwise their solutions “will give imaginary numbers“. What a stupid argument! Aren’t they aware of the fact that all numbers are imaginary signs? They are symbols of the mind - the platonic shadows of the real world. Why don’t these guys study Greek philosophy! This will help them avoid such stupid conclusions. As I see, the byzantine scholar also disproves their conclusion. Good! He proves that the aggregated velocity of the particles is greater than the speed of light (equation (189c)). If velocity is a mathematical quantity of energy, as I have defined it for gravitation, it follows that the particles of matter must have a greater energy than light. This physical fact was predicted by the famous Thracian atomist - **Democritus**. He teaches us that atoms have emerged from light - they are condensed light and must have more energy than light. In this case, their velocity is greater than that of light. Democritus is, indeed, a good

student of great Heraclitus who says: „Da tutte le cose ne sorge una sola, e da una sola possono sorge tutte.<sup>217</sup>“ This is an exciting idea. I will have to work it out, after I have finished with this experiment and, if I may hope, the inquisition will no longer border me. Heraclitus idea that all objects emerge from light (flux) and disappear in light seems to be a key idea of this byzantine scholar who also comes from Thracia. Indeed, to believe that the speed of light is the maximal possible speed, only because a mathematical solution of an artificial equation will render imaginary numbers is not at all convincing to me. I wonder how many physicists will earnestly believe this nonsense in the future. I suppose that such erroneous conclusions stem from a misapprehension of the fact that physics is applied mathematics. Only when this fact is well understood, can we perceive why most non-mathematical interpretations of physical results are not true. I recommend all future scholars to consider my advice seriously, not only because I am the founder of modern physics, but because I am in the first place an excellent mathematician.“

Galilei scrutinizes Nostradamus' books silently for a while, then exclaims: „There it is! Lorentz, Einstein & Co. seem to realize this truth too. They argue that if  $E$  is much greater than the mass at rest  $m_0c^2$  in equation (262), that is, if  $m_0c^2 \rightarrow 0$ , then  $E = pc$ ; this would say that if the side of the right triangle  $b$  approaches zero  $b \rightarrow 0$ , then  $a$  will approach  $c$ :  $a \rightarrow c$ . Evidenza! In this case, the energy in  $a$  is equal to the energy in  $c$ . Questo lo chiamo “**istinto di conservazione**“. Ecco la!<sup>218</sup> Energy cannot be destroyed. How right was Heraclitus to say: “Il mondo che abbiamo intorno, e che è lo stesso per tutti, non lo creò nessuno degli Dei o degli uomini, ma fu, è, e sempre sarà, Fuoco vivente. Un bel Fuoco che divampa e si spegne secondo misura.”<sup>219</sup>

---

<sup>217</sup> One thing emerges from all things, and all things can emerge from one thing.

<sup>218</sup> “I call it the “conservation of momentum“. That’s it!“

<sup>219</sup> “The world which surrounds us is the same for everybody, no God or humans have created it, but it **was, is, and will** always **be a living fire**. A wonderful fire that extinguishes and ignites to a precise measure.“

### The Numerical Input-Output Model of Space-Time

And now back to the derivation rule of absolute constants, with which space-time - *quel bel fuoco* - can be expressed as a numerical **input-output model** of the power of the continuum. We shall use this rule to derive the famous **Sommerfeld's constant  $\alpha$  of fine structure**. It is one of the few dimensionless constants known at present. We shall show that this constant assesses the vertical energy exchange between the electron level of matter and the photon level. The space-time of the **electron level**  $E_e$  can be assessed by Coloumb's law as a horizontal interaction between two electrons (action potentials) according to the axiom of reducibility:

$$E_e = F_e r = \frac{e^2}{4\pi\epsilon_o r} = SP(A)[2d\text{-space-time}]_e \quad (263),$$

where  $r$  is any distance between the electrons. The energy of the **photon level**  $E_p$  can be given by Planck's equation for any photon system described as a rotation within geometry:

$$E_p = \hbar f = \frac{h}{2\pi} f = \frac{hc}{2\pi\lambda}, \text{ as } f = c/\lambda \quad (264)$$

The conventional epistemological approach to this presentation is as follows: the photon is regarded as a "virtual photon" that is incessantly exchanged between two interacting electrons. In terms of the new axiomatics, photons are mediators of horizontal energy exchange between electrons as assessed by Coulomb's law. Any horizontal interaction involves a vertical energy exchange as given by Planck's equation for the photon level. According to the axiom of conservation of action potentials, the energy of the virtual photon which is exchanged between the two interacting electrons is equivalent to Coulomb's energy of the electrons as given in equation (263). If we now build a **quotient**  $K_{1,2}$  between the energies (space-times) of the two levels,  $E_e$  and  $E_p$ , according to the principle of circular argument, we obtain the **absolute constant** of vertical energy exchange between the **electron level** and the **photon level**:

$$K_{1,2} = \frac{E_e}{E_p} = \frac{e^2}{2\epsilon_o hc} \left[ \frac{\lambda}{r} \right] = SP(A) \quad (265)$$

At this point, we apply the actual **derivation rule** of **absolute constants**. It is based on an *a priori* knowledge of the properties of space-time. The two

[1d-space]-quantities of the electron level  $r$  and the photon level  $\lambda$  are presented separately in parenthesis. They assess the space of the two levels with respect to the corresponding systems: the resultant electric system from the interaction of two electrons at the *distance*  $r$  and the virtual photon exchanged during this interaction with the *wavelength*  $\lambda$ . In equation (265) they build a quotient (comparison) according to the principle of circular argument.

Equation (265) is an application of the universal equation as a rule of three. In this generalized form it holds for any electric and photon system that can be observed. The two systems can be regarded as action potentials of their corresponding levels (degree of mathematical freedom). According to the axiom of conservation of action potentials, the energy of the first action potential is completely transformed into the energy of the second action potential and vice versa (point 34.). In this particular case, the constant space of the electric system given as  $r$  is completely transformed into the constant space of the virtual photon given as  $\lambda$  and vice versa. We can express this equivalence (conservation of space-time) in a formal mathematical way by eliminating the [1d-space]-quotient in the parenthesis.

In reality, the two [1d-space]-quantities build a **constant** dimensionless relationship. As space-time consists only of space and time, this relationship is already included in the constants that build the quotient in front of the parenthesis. This results from the universal equation as a rule of three. The quantities in front of the parenthesis are conventionally expressed as **natural constants** with SI dimensions, e.g. electron charge  $e$ , permittivity of free space  $\varepsilon_0$ , Planck's constant (basic photon)  $h$  and speed of light  $c$ . By employing the new space-time symbolism, we have proved that these constants are also dimensionless quotients. From this we conclude:

The **derivation rule** of **absolute constants**  $K_{1,2}$  allows the simple derivation of **dimensionless (absolute) constants** from conventional constants given in SI units. In this way, all known natural constants can be expressed as absolute constants within mathematical formalism. This leads to the elimination of the SI system as an anthropocentric surrogate and allows the expression of space-time as a numerical **input-output model** that is equivalent to the continuum.

For instance, when we eliminate the quotient in the parenthesis of equation (265), we obtain the famous **Sommerfeld's constant of fine structure** as a quotient of known constants:

$$\alpha = \frac{E_e}{E_p} = \frac{e^2}{2\varepsilon_0 hc} = \frac{1}{137,036} \quad (266)$$

**Sommerfeld's constant of fine structure** is an absolute constant of the vertical energy exchange between the electron level and the photon level which is obtained by the novel derivation rule.

The transitiveness (equivalence) between the new axiomatics and the conventional presentation of physical quantities in the SI system (in SI dimensions and units) becomes cogent when we express Sommerfeld's constant in the new space-time symbolism:

$$\alpha = \frac{E_e}{E_p} = \frac{e^2}{2\epsilon_0 hc} \left[ \frac{\lambda}{r} \right] =$$

$$= \frac{SP(A)^2 [2d - Raum] \times [1d - Raumzeit] f \left[ \frac{[1d - Raum]}{[1d - Raum]} \right]}{SP(A) [2d - Raum] f [1d - Raumzeit] \left[ \frac{[1d - Raum]}{[1d - Raum]} \right]} = SP(A)$$

(266a)

Sommerfeld's constant plays a key role in QED. This discipline of quantum mechanics is based on two fundamental constants,  $m_e$  and the coupling constant  $e$  (should not be confused with the electron charge). Within mathematical formalism (theory of probabilities), the constant  $e$  is defined as the **average probability amplitude** with which a real electron absorbs a real photon and emits it at the same time. The mathematical method of definition is known as the “**sum over the histories**“, and was first introduced by *R. Feynman*. Together with *Tomonaga* and *Schwinger*, he is one of the founders of **quantum electrodynamics** (QED). However, Sommerfeld's constant cannot be explained by QED in terms of knowledge. This creates insurmountable cognitive problems to quantum physicists as confessed by Feynman himself:

“There is a most profound and beautiful question associated with the observed coupling constant,  $e$  - the amplitude for a real electron to emit or absorb a real photon. It is a simple number that has been experimentally determined to be close to -0.08542455. (My physicist friends won't recognise this number, because they like to remember it as the inverse of its square: about 137.03597 with an uncertainty of about 2 in the last decimal place. It has been a mystery ever since it was discovered more than fifty years ago, and all good theoretical physicists put this number up on their walls and worry about it.) Immediately you would like to know where this number for a coupling constant comes from: is it related to  $\pi$ , or perhaps to the base of natural logarithms? Nobody knows. It's one of the *greatest* damn mysteries of physics: a *magic number* that comes to us with no understanding by man. You might say the “hand of God” wrote this number, and

“we don’t know how He pushed His pencil”. We know what kind of a dance to do experimentally to measure this number very accurately, but we don’t know what kind of a dance to do on a computer to make this number come out - without putting it in secretly.”<sup>220</sup>

In the light of the Universal Law, this “greatest mystery“ of physics finds a simple solution. The coupling constant  $e$  is the reciprocal of Sommerfeld’s constant and is thus a simple coefficient of vertical energy exchange between the electron level and the photon level. There are infinite absolute constants of nature which assess constant space-time relationships between systems and levels. Their method of definition is mathematics. Such quotients can be expressed as probabilities that belong to the physical probability set:  $0 \leq SP(A) \leq 1$ . Physics, including QED and QCD, is mathematics applied to the physical world. This is the simple message of the Universal Law. As this fact has not been realized so far, the unreflected application of statistics in quantum mechanics has led, to quote Feynman, to a “loss of common sense in order to understand what is happening at the microscopic level.“ On this occasion, the founder of QED gives a devastating comment on the state-of-the-art of physics:

„...The more you see how strangely Nature behaves, the harder it is to make a model and explain how even the simplest phenomena actually work. So theoretical physics has given up on that“.

Let us put it more precisely: physicists have given up their pursuit to understand nature, but not their futile efforts to develop numerous abstract models of no cognitive value, with which they disguise their cognitive helplessness. This is the hypocrisy of twentieth century physicists, to which Zola’s famous “J’accuse“ is the only adequate response. How metaphysically physicists proceed in their efforts to comprehend nature, is documented by another quotation of Feynman:

“A good theory would say that  $e$  is the square root of 3 over  $2\pi$  squared, or something. There have been, from time to time, suggestions as to what  $e$  is, but none of them has been useful. First, Arthur Eddington proved by pure logic that the number the physicists like had to be exactly 136, the experimental number at that time. Than as more accurate experiments showed the number to be closer to 137, Eddington discovered a slight error in his earlier argument, and showed by pure logic again that the number had to be the *integer* 137! Every once in a while, someone notices that a certain combination of  $\pi$ ’s and  $e$ ’s (the base of the natural logarithms), and 2’s and 5’s produces the mysterious coupling constant, but it is a fact not fully

---

<sup>220</sup> R.P. Feynman, QED, The Strange Theory of Light and Matter”, Penguin Books, 1985, p. 129.

appreciated by people who play arithmetic that you would be surprized how *many* numbers you can make out of  $\pi$ 's and  $e$ 's and so on. Therefore, throughout the history of modern physics, there has been paper after paper by people who have produced an  $e$  to several decimal places, only to have the next round of improved experiments disagree with it.<sup>221</sup>

We shall finish this unglamorous discussion on the epistemological misery of modern physics and present instead another important formula of Sommerfeld's constant:

$$\alpha = \frac{e^2}{2h} f_U \quad (267)$$

This equation gives valuable additional information on photon space-time. The time quantity  $f_U$  is called **universal photon time**. Its magnitude can be easily obtained from the *electric acceleration* of photon space-time (equation (109)):

$$f_U = \frac{E_a}{c} = \frac{0.11294 \times 10^{12}}{2.9979246 \times 10^8} = 0.37673 \times 10^3 \quad (268)$$

The universal photon time  $f_U$  is a **new** constant that is obtained for the first time in physics (see also Table 1). Equation (268) is derived from Maxwell's equation of the speed of light as given in equation (105).

The new constant  $f_U$  assesses the **mean angular frequency** of rotation of stars, pulsars and other major gravitational systems of matter in the universe.

It corresponds very well to the predicted rotational frequency of **neutron stars** (*pulsars*)  $\omega \cong 10^3 - 10^4 \text{ s}^{-1}$ , as the radius of these gravitational systems is estimated to be about  $R \cong 5 \times 10^4 - 5 \times 10^5 \text{ m}$ .<sup>222</sup> This [*1d-space*]-value is very close to the magnitude of the magnetic field length  $l_{\mu\omega}$  of photon space-time (see equation (110)):  $l_{\mu\omega} = 7.95775 \times 10^5 \text{ m} \cong 2R = R_s = \text{Schwarzschild radius}$  (245), which is another new fundamental cosmological constant (see chapter 6.3). Equation (268) proves that the rotational kinetics of photon space-time as assessed by electromagnetism (Maxwell's equation of the speed of light) is **determined** by the rotational kinetics of celestial bodies, mainly by black holes, neutron stars (pulsars) and less so by normal stars, such as our sun ( $\omega = 3.10^{-6} \text{ s}^{-1}$ ). This can be illustrated by the following example. The mag-

<sup>221</sup> R.P. Feynman, QED, p. 129-130

<sup>222</sup> R. & H. Sexl, chapter 5. p. 64-70

netic field  $B$  (equation (143)) of pulsars is estimated to be about  $10^8$  tesla (between  $10^6 - 10^8$  tesla)<sup>223</sup>. We have shown that the magnetic field of the earth is about  $10^{-4}$  tesla for one revolution, that is:  $B_{earth} = 1 \text{ rev} \cong 10^{-4} \text{ tesla} \cong 10^4 s$  (see equation 144). If we want to know the angular frequency of pulsars, that is, the number of revolutions of pulsars per second, we simply have to multiply their magnetic field with the magnetic field of the earth:

$$\begin{aligned} \omega_{pulsar} = f &= B_{pulsar} \times B_{earth} \cong 10^8 \text{ tesla} \times 10^{-4} \text{ tesla} = \\ &= 10^4 \text{ tesla} = 10^4 s^{-1} = SP(A) \end{aligned} \quad (269)$$

This value corresponds to the predicted angular frequency of pulsars as estimated by the new constant  $f_U$  in equation (268). As we see, physics has introduced a variety of pleonastic expressions that assess the space and time of celestial objects. The above derivations are a fundamental proof that,

while space-time is a closed entity, the systems and levels are open and mutually determine their constant space and time.

In this particular case, the rotational kinetics of electromagnetic photon space-time is determined by the rotational kinetics of the gravitational systems of matter:

The wave character of photon space-time as expressed by the speed of light in electromagnetism:

$$c = E_o/f_U = \sqrt{l_{\mu_o} E_o} = f_U l_{\mu_o} = [1d\text{-space-time}]_p \quad (270)$$

is determined by the **average rotational space-time** of such gravitational systems, as black holes, pulsars, quasars, stars etc:

$$v = f_U l_{\mu_o} = 2 \omega_{ave} R_{ave} = [1d\text{-space-time}]_G \quad (271)$$

This is the simple cognitive basis of the **new cosmology** of the Universal Law. Equations (270) and (271) are basic proofs that all motions of space-time are **superimposed rotations** (U-sets). They integrate cosmology, electromagnetism and quantum mechanics, and establish a numerical input-output model of the universe:

$$primary \text{ term} = space\text{-time} = energy = universe =$$

---

<sup>223</sup> R. & H. Sexl, chapter 5.2, p. 69; J. Herrmann, Wörterbuch zur Astronomie, dtv, München, 1996, Pulsare, p. 392-394.

$$= \text{input-output model} = \text{continuum} \quad (272)$$

The derivation rule can be used to obtain the following **new** absolute constants of vertical energy exchange (the first constant is known):

a) The **fine structural constant of gravitation**  $K_G$  assesses the vertical energy exchange between the gravitational proton level (Newton's law of gravity) and the photon level as given in Chandrasekhar's equation of finite lifetimes of stars:

$$K_G = \frac{E_G}{E_p} = \frac{Gm_{pr}^2}{\hbar \cdot c} \cong 6 \times 10^{-39} \quad (273)$$

b) The new **absolute constant of thermodynamics**  $K_T$  assesses the vertical energy exchange between the thermodynamic levels of matter (Boltzmann's law) and photon space-time (Stankov's law):

$$K_T = \frac{dK_{(ave)}}{dE_p} = \frac{3 k_b}{2 K_s} \cong 0.3017 \quad (274)$$

c) The new **absolute constant of thermoelectric exchange**  $K_{TE}$  assesses the vertical energy exchange between the electron level (Coulomb's law) and the kinetic, thermodynamic level of matter (Boltzmann's law):

$$K_{TE} = \frac{E_e}{K_{(ave)}} = \frac{e^2}{6\pi\epsilon_0 k_b} \cong 1.1 \times 10^{-5} \quad (275)$$

d) The new **absolute constant of thermo-gravitational exchange**  $K_{TG}$  assesses the vertical energy exchange between the gravitational proton level (Newton's law of gravity) and the kinetic, thermodynamic level of matter (Boltzmann's law):

$$K_{TG} = \frac{E_G}{K_{(ave)}} = \frac{2Gm_{pr}^2}{3k_b} \cong 9.018771 \times 10^{-42} \quad (276)$$

e) The new **absolute constant of electro-gravitational exchange**  $K_{EG}$  assesses the vertical energy exchange between the gravitational proton level (Newton's law of gravity) and the electron level of matter (Coulomb's law):

$$K_{EG} = \frac{E_G}{E_e} = \frac{Gm_{pr}^2 4\pi\epsilon_0}{e^2} = 8.106 \times 10^{-37} \quad (277)$$

We can express the above constants in the new space-time symbolism and prove that they are dimensionless relationships. We leave this exercise to the reader. The number of such constants is infinite because space-time is infinite. The same holds true for the degree of mathematical freedom, which is the source of any physical quantity. This is the epistemological background of the Universal Law that leads to the axiomatization of all natural sciences to a **General Theory of Science** based on a single term - the primary term of space-time (energy).

*Exercise:*

1. Prove that the microscopic and macroscopic properties of matter are determined by the space-time properties of electromagnetism and gravitation.

*Solution:* The *microscopic* properties of matter depend exclusively on the properties of the *elementary particles*, such as *electron*, *proton* and *neutron*. Based on the definition of the primary term (space-time, energy) we have shown in this volume that all elementary particles are completely described by their *mass* (energy relationship), *energy* (space-time), *Compton-wavelength* ( $[1d\text{-space}]$ ) and *Compton-frequency* (time). All other quantum magnitudes employed in physics today can be derived from these four basic physical quantities, which are currently regarded as *fundamental natural constants* (see Table 1.). This is the only task of modern quantum physics as shown in section 7. In chapter 3.9 and in section 7., we have proved that these basic microscopic constants of matter can be easily calculated from the *mass of the basic photon*  $m_p = h/c^2$ . This novel natural constant is the *primary reference unit*, from which all other known natural constants can be derived within the SI-system by using the universal equation. We have further shown that the *macroscopic mass* of matter can be calculated from the masses of the elementary particles. The mass of material objects is a basic quantity in classical mechanics, e.g., in Newton's laws, and in cosmology. In this section we have proved that the fundamental cosmological constants, the *circumference of the event horizon*  $S_U$ , assessing the extent (space) of the visible universe, and the *universal gravitational constant (universal gravitational acceleration)*  $G$  can be derived from the *speed of light*  $S_U G = c^2$  (37a).

In chapter 6.3 we have explained for the first time in the history of physics the actual dimensionality of the two fundamental constants of electromagnetism,  $\epsilon_0$  and  $\mu_0$ , by deriving two novel fundamental constants: the *universal electric field or acceleration*  $E_0=1/\epsilon_0$  and the *magnetic field length*  $l_{\mu_0}=1/\mu_0$ . These constants are basic to all known laws of electricity and magnetism and determine the four Maxwell's equations of electromagnetism (section 6.). Finally, we have shown in this chapter that the two constants give, in fact, the *rotational space-time kinetics* of celestial bodies (eq. (268) to (271)), thereby rendering the ultimate proof that *space-time is a closed, continuous entity of*

*interrelated, interdependent systems and levels* that can be described in terms of *superimposed rotations or waves*. This fundamental physical insight has been proven in detail for all macroscopic and microscopic systems and levels of matter and photon space-time (sections 4., 7. and 9.) In this way, we have shown that the two fundamental constants of electromagnetism, conventionally defined as „permittivity and permeability of free space“, are at the same time *fundamental cosmological constants*. This is the ultimate proof that the micro- and macroscopic electromagnetic properties of matter and photon space-time depend exclusively on the macroscopic gravitational properties of cosmological matter. It also allows the unification of electromagnetism with cosmology. Departing from Maxwell's famous equation of the speed of light,  $c^2 = 1/\epsilon_0\mu_0 = E_0 l_{\mu_0}$ , we shall now link the two fundamental constants of electromagnetism and cosmology with the other two basic constants of cosmology,  $S_U$  and  $G$ , which assess the universal gravitation, for instance, in the novel derivation of *Newton's law of gravitation*  $E = E_{AU}f = c^3/Gf$  ((28), chapter 3.6):

$$E_0 l_{\mu_0} = S_U G \quad (278)$$

This equation is an application of the universal equation as a rule of three. It unites all fundamental physical constants of gravitation ( $G$ ), electromagnetism ( $E_0=1/\epsilon_0$  and  $l_{\mu_0} = 1/\mu_0$ ) and cosmology ( $S_U$ ) in a simple and straightforward manner and puts them in a direct relationship to the reference constant  $m_p$ .

$$m_p = \frac{h}{E_0 l_{\mu_0}} = \frac{h}{GS_U} = \frac{\text{Energy}_{\text{minimal}}}{\text{acceleration} \times \text{length}} \quad (279)$$

Equation (279) represents the utmost possible unification of all fundamental physical constants. It encompasses the whole physical knowledge, one can acquire upon Nature<sup>224</sup>. For instance, it includes the *universal action potential*  $E_{AU} = c^3/G$  (30) of the vertical energy exchange between matter and photon level, which is responsible for gravitation. The *elementary action potential*  $h$  of the photon level is at the same time the elementary action potential of all elementary particles that build the level of matter - their energies and masses are  $f$ -times (given as Compton-frequencies) greater than  $h$  and  $m_p$ . It is the smallest energy package that we can discriminate at present, both with our senses (e.g. vision) and material instruments<sup>225</sup>. Our perception of space-time (Nature) is

<sup>224</sup> Observe that this equation is identical with the *work equation* in mechanics:  $W = E = Fs = mas$ , hence  $m = W/as = E/as$ .

<sup>225</sup> It is important to stress that all measurements and results obtained with instruments or other external material devices must ultimately be perceived with our senses, which are highly limited in their perception of external or internal energetic interactions. For instance, the whole optical information which we acquire from the external world is limited to the narrow frequency-range of the visible light according to equation  $E = hf$ .

limited by this very constant. As already discussed in conjunction with *Heisenberg uncertainty principle* (chapter 7.3), its magnitude limits the intelligibility of the physical world through experiments. Therefore, we can as well speak of ***h-space-time***, which is a particular *U*-subset of the primary term. Human beings have only access to this level of space-time. Physics, as developed throughout history and presented in this volume, is exclusively limited to the *h-space-time*. Until now, mankind has no experimental or theoretical knowledge beyond the limit of the elementary action potential. Departing from equation (278), we can now draw some extremely valuable conclusions, which have not yet been made. Both *G* and  $E_o$  are *accelerations*, describing the levels of gravitation and electromagnetism (photon space-time), while  $S_U$  and  $l_{\mu o}$  are basic [*1d-space*]-quantities of same. By rearranging this equation, we can easily compare the fundamental space-time magnitudes of these two levels:

$$k = \frac{S_U}{l_{\mu o}} = \frac{E_o}{G} \cong 1,69 \times 10^{21} \quad (280)$$

This equation is another irrefutable proof for the reciprocity of space and time, in this case, the constituent „time“ *f* being assessed by the acceleration:  $a=G=E_o=[1d-space] f^2$ . We conclude: The greater the acceleration, the smaller the space (extent) of the system or level of space-time - for instance, the smaller the elementary particle, the greater its *angular acceleration* and subsequently its *angular and tangential velocities* (see Bohr model). Equation (280) also reveals that energy exchange from one level to another occurs in **quantitative leaps**. The space and time magnitudes change from one level to another abruptly - for instance, the universal electric acceleration  $E_o$  is in the order of  $10^{21}$  times greater than the universal gravitational acceleration *G*. The same is true for the space-magnitudes of these levels:  $S_U/l_{\mu o}$ . The new *absolute constants of vertical energy exchange* presented in this chapter (eq. (273) to (277)) give the range of quantitative changes in the space and time magnitudes during energy exchange between fundamental levels of space-time. Similar quantitative leaps should be postulated between the level of *h-space-time* and the *hypothetical levels beyond the limit of the elementary action potential*. These underlying levels may appear to be the primary event, from which the level of *h-space-time* has evolved in a secondary manner. This insight will inevitably lead to the development of a new *h-transcendental physics* that will pulverize the limited and inherently wrong physical concepts of Nature, currently cherished by a misguided mankind<sup>226</sup>.

---

As most of the information, we gather from the external world in scientific research or daily life, is of optical character, our very concept of space-time as a *three-dimensional entity* is based on our insufficient vision.

<sup>226</sup> For further information see my books „New Gnosis“ and „Gnostic Tradition of European Philosophy“.

## CONCLUSION

*Western civilization* has straddled a long and weary way from antiquity to present days, before it was catapulted back to its origin. Since Heraclitus, the first man who defied nature with an intellectual contempt for superstition, and, like a mortal Prometheus, stole the primordial fire from the Olympic gods to give it to humans as *Logos*, more than 2500 years have gone, before a modern heir of this herald could develop anew a deep insight into the existence of One Single Law of Energy behind the visible plurality of natural phenomena. He discovered the Universal Law of space-time and set it equivalent to his consciousness. After Tantalus' efforts, he derived from the depth of his tormented mind all scientific terms and ideas from one term by a pure artistic intuition which he cherished during his whole life:

„The ACT OF LIVING  
Is nothing else, but an incessant session  
Of abstract signs we fear to enter.  
Of still lives and of blank obsessions,  
Which sprout from deliberate depressions  
That twist the world and shake the centre.

The temper  
Of a cursed inventor  
Is horrid mentor  
Trying to render  
A false commotion  
Into MOTION.

And the excuse we used then to imply  
Was changing truth into a soothing LIE.  
The TIE  
With intellectual prescriptions and forced decisions  
Is cut by a deeply rooted premonition  
In the existence of an innate strong collision  
That leads us to the Orphic Greek tradition  
And proves how true the voice is of an  
ARTIST'S INTUITION.<sup>227</sup>

---

<sup>227</sup> A fragment from the poem „The Birth of the Dissident Mind“, written between 1972 and 1975 during my dissident activities in Bulgaria.

Two thousand and five hundred years of written European history and intellectual endeavour - an eternity in terms of a single human life, an instant in cosmological dimensions. As all events of space-time are action potentials and, therefore, recurrent events, we inevitably come back to the original source, from which the current of historical events has emerged. But while the current is still the same, the running water has changed - *pantarei*. Evolution is an incessant process of continuous space-time that shapes the appearance of events, but not their essence - that of the Law. It is eternal.

During its passage in space and time, western civilization has evolved according to the Law, even when it acted against the Law. The consequences of such breaches with the Law are repeated dissipations of society and civilization. Written and oral history of mankind is a chronology of such events - wars, rise and fall of empires and states, revolutions and plagues. Each time human civilization reaches the verge of annihilation it becomes aware of the intrinsic power of the Law and unconsciously abides by its logic<sup>228</sup>. Thus the history of mankind, as embodied by the toil of individual destinies, appears to be a long and dangerous Odyssey back to its origin, only to discover that peace and happiness are not constant quantities of human mind, but variables of motion, that is, of space-time. Man is destined to labour like Sisyphus before he finally realizes that peace and happiness are elusive ideas of man's striving for eternal harmony with the cosmos. In this process of trial and error, humans finally learn that the Logos rejects any statics, and that human civilization is subjected to a forward spiral motion leading to unknown destiny. Ultimately, man realizes that he is a **demiurge of his own destiny** - the destiny to shape his own present and future in accordance with the Law.

The last white specks on the earth's globe were erased at the beginning of this century. Since then mankind "cerca un paese innocente"<sup>229</sup>, not knowing that this "search for an innocent land" can only proceed in the infinite space-time of human consciousness. Like a modern Ulysses of James Joyce, our restless consciousness sets off for a voyage full of adventures and sails to an unknown end. But the end of human existence is predetermined from its very beginning - it begins with an unrestricted identification of consciousness with the exuberance of space-time and ends up with the re-discovery of this mental state. In this spiritual evolution of human mind, the principle of last equivalence is accomplished step by step. Finally, the individual traits of any daring

---

<sup>228</sup> "Gli uomini non intendono il Logos, né prima di averlo udito, né dopo averlo ascoltato. E malgrado ogni cosa intorno a loro si manifesti in funzione del Logos, si comportano come quelli, che, pur non avendo esperienza, intendono operare ugualmente." (People do not care about the Logos, neither before they have heard of it, nor thereafter. And although all things that surround us manifest themselves as functions of the Law, they comport themselves, as if they had no experience with the Logos.) Fragments of Heraclitus in Sesto Empirico, Against the scientists.

<sup>229</sup> From Girovago, Ungaretti, 1919.

character dissolve in the infinite plurality of being and human character evolves to Musil's "Mann ohne Eigenschaften"<sup>230</sup>. This voluntary dissolution of the individual personality into the infinity of space-time engenders a new, metaphysical dream, only comparable to Gatsby's innocent dream, "to the last and greatest of all human dreams", born in the light-footed Jazz Age that has been abruptly terminated by the turmoil of two world wars, the consequences of which are still tormenting the collective soul of mankind:

„For a transitory enchanted moment man must have held his breath in the presence of this continent, compelled into an aesthetic contemplation he neither understood nor desired, face to face for the last time in history with something commensurable to his capacity for wonder."<sup>231</sup>-

A fragile mankind, indeed, perplexed by the incommensurability of space-time, it nurtures the vague hope of survival in an eternal and infinite world.

---

<sup>230</sup> "A man without characteristics", a novel written by R. Musil.

<sup>231</sup> S. Fitzgerald, *The Great Gatsby*. These quotations from the most influential novels of the twentieth century intend to illustrate the new introspective thinking that emerges at the end of this Millennium and will dominate the next one.

**FIGURE 3:** Basic Features of the New Physical Axiomatics and Mathematics

<b>Features</b>	<b>New Physical Axiomatics</b>	<b>Mathematics</b>
<i>Primary term:</i>	space-time/energy/universe/ being/continuum/etc. <i>real thing</i>	Continuum/space continuum/ probability set <i>object of thought</i>
<i>Properties:</i>	continuousness, closed character, infinity, inhomogeneity, energy exchange, conservation of energy	continuousness, infinity, inhomogeneity, discon- tinuousness of closed real numbers, potentially open, no statements on closed character
<i>Parts:</i>	systems, action potentials, levels	Numbers, series and sets, geometric figures, geometric spaces, etc.
<i>Properties of the parts:</i>	open, no exact equivalence possible = physical transcendence	rational and real algebraic numbers: closed; geometric figures: closed; exact equivalence: abstract definition. transcendental numbers: open; no exact equivalence possible
<i>Antinomies and Paradoxes:</i>	none	yes, Russell's antinomy continuum hypothesis, many paradoxes
<i>Epistemology:</i>	From the whole (space-time/energy) to the parts (systems/levels)	From the parts (numbers and their relations) to the whole (continuum, probability set)
<i>Method:</i>	Principle of last equivalence for the primary term; principle of circular argument for the parts; inner consis- tency and lack of contradictions: complete, experimentally verifiable axiomatics: proof of existence	circulus viciosus as deduction, incomplete formalism; no finite procedures possible (Gödel), hermeneutics = no proof of existence
<i>Nature of the primary term:</i>	unity of two canonically conjugated, reciprocal constituents, space and time : $space-time = [space] \times [time] =$ $= 1 = const.$	unity of the infinite great number and its reciprocal value, the infinite small number: <i>continuum/probability set</i> = $= \infty \times 1/\infty = 1 = const.$
<i>Basic equation:</i>	Universal equation/Universal Law: $E = E_A f = SP(A)[2d-Raumzeit]$ or $E/E_A f = 1$	rule of three: $y = ax$ or $y/ax = 1$
<i>Operations of the basic function:</i>	all known physical laws, terms, quantities, actual magnitudes and concepts	all mathematical operations, axioms, functions, proofs and disciplines
<i>Scope:</i>	Unified theory of mathematics and science; efficient research to modulate space-time for the benefit of society; new ethics	incomplete mathematical axiomatics; no axiomatics of empirical sciences; no ethics

**FIGURE 4: Vademecum of the New Axiomatics of the Universal Law**

1. Knowledge begins with the **whole** in order to explain the *parts* (new physical axiomatics).
2. The *whole* is the **primary term (PT): energy= space-time =  $E=1=\infty$** . This is the **principle of last equivalence (PLE)**: all words & symbols for PT are equivalent. Consciousness is equivalent to PT.
3. Space-time is *closed* (conservation of energy), *continuous* (no vacuum), *inhomogeneous* ( $E_A$ , quantization of energy), *constant* (constant  $E_A$ ), *infinite* (without a beginning and an end, because closed) and in a permanent energy exchange (open parts).
4. The parts are: equal *systems = levels* of energy/space-time. They are *U*-sets of equivalent elements that contain the whole as an element.
5. The systems are *open U*-subsets of space-time (energy exchange), have a *constant* space-time, and are *infinite* in real and cognitive terms.
6. The space-time of the systems can be compared/measured by applying the **principle of circular argument (PCA)**. PCA is PLE for the parts (*U*-subsets).
7. Space-time has only two constituents/quantities: **space** and (**absolute time**). Due to energy quantization, time is a quotient  $f = E/E_A$  (PCA). Space is a quotient of extents. Both are pure numbers.
8. All *physical quantities*, with which the parts of space-time are described, are abstract concepts that are defined through mathematics (objects of thought). This is also true for space & time. They have no distinct existence in reality. Mathematics (mat) is the **method of definition and measurement (MDM)** of physical quantities and their relationships, called „physical laws“. Physical quantities exist only in mat and through mat. Number „1“ as *1unit*, or as the „certain event“,  $SP(A) = 1$  is the fundamental symbol for creating new quantities in mat and comparing them according to PCA.
9. Space [*nd-space*] and time  $f$  are *canonically conjugated, reciprocal entities* that build the unity of space-time: [*space-time*] = [*space*]  $f = 1$ . They cannot be separated in reality, but only in the mind.
10. The equation of the **Universal Law (UL)** is directly derived from the primary term:  $E = E_A f$ .

11. The **Universal Equation (UE)** is the origin of math and physics (physics is applied math). The *continuum*  $n$  and the *probability set*  $0 \leq \text{SP}(A) \leq 1$  are equivalent abstract ideas (objects of thought) of space-time (the only real thing). All mat operations are derived from UE and adequately assess space-time. Mat is part of the new axiomatics.
12. *Motion* is the universal manifestation of energy exchange. *Velocity*  $v$  is the universal quantity for assessing space-time as energy exchange. Its MDM is geometry = new [*space-time*]-symbolism:

$$E = v = [1d\text{-space-time}] = [1d\text{-space}]f = v^n = \\ = [nd\text{-space-time}] = \infty \times 1/\infty = 1$$

13. Energy is proportional to time  $f$ ,  $E \approx f$ , and *inversely* proportional to space:  $E \approx 1/[1d\text{-space}]$ .
14. All physical quantities are  $U$ -subsets of space-time and consists of space and/or time. From their MDM (mat), they can be symbolized as  $n$  or  $\text{SP}(A)$ . We reserve  $\text{SP}(A)$  for *charge*  $Q$ , which is a space-quotient  $Q = \text{SP}(A)$  and *mass*  $m$ , which is space-time/energy quotient  $m = \text{SP}(A)$  (PCA).
15. The **three** symbols of the new axiomatics are: [ $n\text{-}d\text{-space}$ ],  $f$  or [ $n\text{-}d\text{-space-time}$ ] and  $\text{SP}(A)$  for charge, mass, or any other relationship of equal quantities, where  $\text{SP}(A) = n$ .
16. **Axiom of reducibility:** Each particular energy exchange  $E$  can be regarded as an energy interaction between two entities. When described by geometry (MDM), the [*space-time*]-expression of UE is:

$$E = E_1 E_2 = m_1 v_1 m_2 v_2 = \text{SP}(A)_1 [1d\text{-space-time}]_1 \text{SP}(A)_2 [1d\text{-space-time}]_2 = \\ \text{SP}(A) [2d\text{-space-time}]$$

17. The *vertical* and *horizontal* energy exchange can be described by energy *coefficients/absolute natural constants* (*input-output* model of universe = continuum  $n$ ). This is another presentation of UE:

$$K_{1,2} = \frac{E_1}{E_2} = \frac{f_1}{f_2} = \frac{[1d\text{-space}]_2}{[1d\text{-space}]_1} = \frac{\text{SP}(A)[nd\text{-space}]_1 f_1^n}{\text{SP}(A)[nd\text{-space}]_2 f_2^n} = \text{SP}(A)$$

18. Energy-exchange is assessed by consciousness in a **dualistic** way: 1) statically as *structural complexity*  $K_s = \text{SP}(A)[2d\text{-space}]$ , when time is arrested in the mind  $f \approx E = 1$  and 2) dynamically as energy interaction  $E = \text{SP}(A)[2d\text{-space-time}]$ , when  $f \neq 1$  (wave-particle dualism, etc.).

## REFERENCES

- Artin, E. und Schreier, O. Algebraische Konstruktionen reeller Körper. *Abh. Math. Sem. Univ.*, Hamburg, 1927, p. 85-99.
- Artin, E. und Schreier, O. Eine Kennzeichnung der reell abgeschlossenen Körper. *Abh. Math. Sem. Univ.*, Hamburg, 1927, p. 225-231.
- Aspect, A. et al. Experimental realization of Einstein-Podolsky-Rosen-Bohm Gedankenexperiment: a new violation of Bell's inequalities. *Phys. Rev. Lett.*, vol. 48, 1982, p. 91-94.
- Barrow, J.D. Die Natur der Natur, Wissen an den Grenzen von Raum und Zeit. rororo, Reinbeck.
- Barrow, J.D. Theorien für Alles, Die Suche nach der Weltformel. rororo, Reinbeck.
- Beck, F. and Eccles, J.C. Quantum aspects of consciousness and the role of consciousness. *Proc. Nat. Acad. Sci.*, vol. 89, 1992, p. 11357-61.
- Bell, J.S. On the problem of hidden variables in quantum theory. *Revs. Mod. Phys.*, vol. 38, 1966, p. 447-52.
- Bell, J.S. Against measurement. *Physics World*, vol. 3, 1990, p. 33-40.
- Beltrami, E. Teoria fondamentale degli spazii di curvatura costante. *Ann. di Mat. (2)*, 1868-69, p. 232-255.
- Bohm, D. Quantum Theory. Dover, New York, 1989.
- Bohm, D. A suggested interpretation of the quantum theory in terms of "hidden" variables, I and II, In Quantum theory and measurement. ed. J.A. Wheeler and W.H. Zurek, Princeton Univ. Press, Princeton, 1983.
- Bolzano, B. Paradoxien des Unendlichen. Leipzig, 1851.
- Boole, G. Collected logical works. 2 vol., ed. P. Jourdain, Chicago, London, 1916.
- Boole, G. An investigation of the laws of thought. Dover, New York, 1958.
- Born, M. Einstein's theory of relativity. Dover, New York, 1962.
- Bosch, K. Elementare Einführung in die Wahrscheinlichkeitsrechnung, Vieweg, Braunschweig, 1993.
- Bortz, J. et al. Verteilungsfreie Methoden in der Biostatistik. Springer, Berlin, 1990.
- Bourbaki, N. Elements of history of mathematics. Springer, Berlin, 1994.
- Brouwer, L.E.J. Zur Begründung der intuitionistischen Mathematik. *Math. Ann.*, 1925, p. 244-257, 1926, p. 453-473, 1926, p. 451-458.
- Cantor, G. Gesammelte Abhandlungen. Berlin, Springer, 1932.
- Churchland, P.M. Matter and consciousness. Brandford Books, MIT Press, Cambridge, Massachusetts.
- Conover, W.J. Practical nonparametric statistics. J. Wiley & Sons, New York, 1980.

- Coveney, P. and Highfield, R. *The arrow of time*. Fawcett Columbine, New York, 1990.
- Dedekind, R. *Gesammelte mathematische Werke*. 3 Bd., Vieweg, Braunschweig, 1932.
- Devlin, K. *Mathematics: the New Golden Age*, Penguin Books, London, 1988.
- DeWitt, B.S. and Graham, R.E. (ed.). *The many-worlds interpretation of quantum mechanics*. Princeton Univ. Press, 1973.
- Diehl, J.M. und Kohr, H.U. *Deskriptive Statistik*. Dietmar Klotz, Eschborn, 1991.
- Dürr, H.-P. (Hrsg.). *Physik und Transzendenz*. Scherz, Bern, 1994.
- Ebeling, W. *Chaos-Ordnung-Information*. H. Deutsch, Frankfurt am Main, 1991.
- Eccles, J.C. Evolution and consciousness. *Proc. Natl. Acad. Sci.*, vol. 89. p. 7320-24.
- Feyerabend, P. *Wider der Methodenzwang*. Suhrkamp, Frankfurt am Main, 1986.
- Fermi, E. *Thermodynamics*. Dover, New York.
- Feynman, R.P. Simulating physics with computers. *Int. J. Theor. Phys.*, vol. 21, 1982, p. 467-88.
- Feynman, R.P. *QED, The strange theory of light and matter*. Princeton Univ. Press, 1985.
- Feynmann, R.P. *Feynman Vorlesungen über Physik*. 2 Bd., Oldenbourg, München, 1991.
- Feynman, R.P. *Vom Wesen physikalischer Gesetze*. Piper, München, 1993.
- Fränkel, A. *Einleitung in die Mengenlehre*. 3. Aufl., Springer, Berlin, 1928.
- Frege, G. *Begriffsschrift eine der arithmetischen nachgebildete Formelsprache des reinen Denkens*. Halle, 1878.
- Frege, G. *Grundgesetze der Arithmetik, begriffsschriftlich abgeleitet*. 2 vol. Jena, 1893-1903.
- Fritsch, H. *Quarks, Urstoff unserer Welt*, Piper, München, 1994.
- Galilei, G. *Opere*. Ristampa della Ed. Nazionale, 20 vol., Barbera, Firenze, 1929-1939.
- Gauß, C.F. *Werke*, 12 vol., Göttingen, 1870-1927.
- Gell-Mann, M. *Das Quark und der Jaguar*. Piper, München, 1994.
- Gödel, K. *Kurt Gödel, collected works*. vol. I-III, ed. S. Feferman et al., Oxford Univ. Press, 1986-1995.
- Gjuzelev, I.N. *Swetât kato produkt na sâznanieto*, Sofia, 1907.
- Gribbin, J. *Die erste Genesis*. bettendorf, Essen, 1995.
- Grof, S. *Geburt, Tod und Transzendenz*. rororo, Reinbeck.
- Hadamard, J. *The psychology of invention in the mathematical field*. Princeton Univ. Press, Princeton, 1945.
- Hahn, G.J and Meeker, W.Q. *Statistical intervals*. J. Wiley & Sons, New York, 1991.

- Hardy, G.H. and Wright, G.M. An introduction to the Theory of Numbers. Oxford, 1932.
- Hasse, H. Kurt Hensels entscheidender Anstoß zur Entdeckung des Lokal-Global-Prinzips. *J. de Grelle*, 1960, p. 3-4.
- Hausdorff, F. Grundzüge der Mengenlehre. Veit, Leipzig, 1914.
- Hausdorff, F. Mengenlehre. de Gruyter, Berlin, 1927.
- Hawking, S.W. Unpredictability of quantum gravity. *Commun. Math. Phys.*, vol. 43, 1982, p. 199-220.
- Hawking, S.W. Eine kurze Geschichte der Zeit, rororo, Reinbeck.
- Hawking, S.W. and Penrose, R. The nature of space and time. Princeton Univ. Press, Princeton, 1996.
- Hensel, K. Über eine neue Begründung der Theorie der algebraischen Zahlen, *Jahresber. der D.M.V.*, 1899, p. 83-88.
- Heisenberg, W. The physical principles of the quantum theory. Dover, New York.
- Hermann, D. Statistik in C. Vieweg, Braunschweig, 1991.
- Herrmann, J. Wörterbuch der Astronomie. dtv, München, 1993.
- Hilbert, D. Gesammelte Abhandlungen. 3 vol., Springer, Berlin, 1932-35.
- Jänisch, K. Topologie. Springer, Berlin, 1996
- James, W. The principles of psychology. 2 vol. Dover, New York.
- Kane, J.W. und Sternheim, M.M. Physics. J. Wiley & Sons, New York, 1988.
- Kant, I. Kritik der praktischen Vernunft. Reclam, Stuttgart.
- Kaltschew, B. Rational-empirische Erkenntnistheorie, Hirzel, Stuttgart, 1987.
- Kazandjiew, S. Istina i Otchewidnost. Pridvorna petschatniza, Sofia, 1936.
- Kolmogoroff, A. Grundbegriffe der Wahrscheinlichkeitsrechnung (Erg. der Math., vol. 2), Springer, Berlin, 1933.
- Kosko, B. Fuzzy thinking. Hyperion, New York, 1993.
- Kuchling, H. Taschenbuch der Physik. Fachbuchverlag, Leipzig, 1995.
- Leibniz, G.W. Mathematische Schriften. 7 vol., Hrsg. C.I. Gerhardt, Ascher-Schmidt, Berlin-Halle, 1849-63.
- Leibniz, G.W. Philosophische Schriften. 7 vol., Hrsg. C.I. Gerhardt, Berlin, 1840-1890.
- Lucas, J.R. The freedom of the will. Oxford Univ. Press, Oxford, 1970.
- Mainzer, K und Schirmacher, W. Quanten, Chaos und Dämonen. BI-Wissenschaftsverlag, Mannheim, 1994.
- Maxwell, J.C. Electricity and magnetism, 2 vol. Dover, New York.
- Meschkowski, H. Einführung in die moderne Mathematik. BI-Wissenschaftsverlag, Mannheim, 1971.
- Meschkowski, H. Mathematik und Realität. BI-Wissenschaftsverlag, Mannheim, 1979.
- Meschkowski, H. Unendliche Reihen. BI-Wissenschaftsverlag, Mannheim, 1982.
- Michalchev, D. Forma I otnoschenie. Graphika, Sofia, 1931.

- Minkowski, H. Gesammelte Abhandlungen. 2 vol., Teubner, Leipzig, Berlin, 1911.
- Minkowski, H. Geometrie der Zahlen. Teubner, Leipzig, 1896.
- Newton, I. Mathematical principles of natural philosophy. Translated into English by A. Motte in 1729, Univ. of California, 1946.
- Newton, I. Opticks (1730). Dover, New York, 1952.
- Peano, G. I principii di Geometria, logicamente espositi, Torino, 1889.
- Peano, G. Démonstration de l'intégrabilité des équations différentielles ordinaires. *Math. Ann.*, 1890, p. 182-228.
- Peeble, P.J.E. Principles of physical cosmology. Princeton Univ. Press, Princeton, 1993.
- Peitgen H.-O, Jürgens, H. und Saupe, D. Chaos and fractals, New frontiers of science. Springer, New York, 1992.
- Penrose, R. The emperor's new mind. Oxford Univ. Press, Oxford, 1989.
- Penrose, R. Shadows of the mind. Oxford Univ. Press, Oxford, 1994.
- Pichot, A. Die Geburt der Wissenschaft, Campus, Frankfurt am Main, 1991.
- Poincaré, H. Oeuvres. 11 vol. Gauthier-Villars, Paris, 1916-1956.
- Poincaré, H. Science et hypothèse. Flammarion, Paris, 1902.
- Poincaré, H. La valeur de la Science. Flammarion, Paris, 1905.
- Raschewskij, P.K. Kurs diferencialnoj geometrii, Moskva, 1939.
- Reichenbach, H. The philosophy of space and time, Dover, New York.
- Riemann, B. Gesammelte Werke, Nachträge, Teubner, Leipzig, 1892.
- Russell, B. and Whitehead, A.N. Principia Mathematica. 3 vol. Cambridge, 1910-1913.
- Schischkoff, G. Gegenwärtige philosophische Probleme der Mathematik. G. Lüttke, Berlin, 1944.
- Schischkoff, G. Peter Beron (Slawische Philosophie), Anton Hain, Meisenheim am Glan, 1971.
- Schischkoff, G. Philosophisches Wörterbuch, Kröner, Stuttgart, 1991.
- Schrödinger, E. Statistical thermodynamics, Dover, New York.
- Sexl, R. und H. Weiße Zwerge - Schwarze Löcher. Vieweg, Braunschweig, 1990.
- Siegel, S. Nichtparametrische statistische Methoden. Eschborn, 1987.
- Sprent, P. Applied nonparametric statistical methods. Chapman & Hall, London, 1990.
- Tabakov, S. Osnovi na analititschnata geometrija, Pridvorna petschatniza, Sofia, 1934.
- Tipler, F.J. Die Physik der Unsterblichkeit. Piper, München, 1994.
- Tipler, P.A. Physics. Worth Publishers, New York, 1991
- Tipler, P.A. Physik. Spektrum Akademischer Verlag, Heidelberg, 1991.
- Tychonoff, A. Über die topologische Erweiterung von Räumen. *Math. Ann.*, 1930, p. 544-561.
- Urysohn, P. Über die Mächtigkeit der zusammenhängenden Mengen, *Math. Ann.*, 1925, p. 262-295.

- von Meyenn, K. (Hrsg.). Lust an der Erkenntnis: Triumph und Krise der Mechanik. Piper, München, 1990.
- von Neumann, J. Die Axiomatisierung der Mengenlehre. *Math. Zeitschr.*, 1928, p. 669-752.
- von Neumann, J. and Morgenstern, O. Theories of games and economic behaviour. Princeton Univ. Press, 1944.
- von Neumann, J. Zur Hilbertschen Beweistheorie. *Math. Zeitschr.*, 1927, p. 1-46.
- von Weizsäcker, C.F. Aufbau der Physik. dtv, München, 1988.
- Weierstrass, K. Mathematische Werke. 7 vol., Mayer und Müller, Berlin, 1894-1927.
- Weyl, H. Theorie der Darstellung kontinuierlicher halbeinfacher Gruppen durch lineare Transformationen. *Math. Zeitschr.*, 1925, p. 271-309, 1926, p.328-395 and 789-791.
- Weyl, H. Symmetry. Princeton Univ. Press, Princeton, 1952.
- Weyl, H. Philosophie der Mathematik und Wissenschaft, Oldenbourg, München, 1990.
- Weyl, H. und Peter, F. Die Vollständigkeit der primitiven Darstellungen einer geschlossenen kontinuierlichen Gruppe. *Math Ann.*, 1927, p. 737-755.
- Whitehead, A.N. On cardinal numbers. *Amer. Journ. of Math.*, 1902, p. 367-394.
- Winer B.J. Statistical principles in experimental design. McGraw-Hill, New York, 1971.
- Zermelo, E. Untersuchung über die Grundlagen der Mengenlehre, *Math. Ann.*, 1908, p. 261-281.



## INDEX

- Absolute coefficients 387-394  
     (see also *absolute constants*)  
 Absolute constants, 387-394  
     of electro-gravitational exchange  
     ( $K_{EG}$ ) 393  
     of thermodynamic exchange  
     ( $K_T$ ) 393  
     of thermo-electric exchange  
     ( $K_{TE}$ ) 393  
     of thermo-gravitational exchange  
     ( $K_{TG}$ ) 393  
     of vertical energy exchange 256  
 Absolute time ( $f$ ) 31-33, 38-43, 51  
 Acceleration, 37, 100-101, 342  
     average 100, 104  
     centripetal 115  
     instantaneous 104  
 Acoustics 168  
 Actio et reactio 105, 108, 139  
 Action at a distance 111,  
     113, 115, 139, 182  
 Action potential, 28-33, 35, 37, 40,  
     48, 55, 58, 61, 64, 69, 77, 80-84,  
     93, 95  
     aggregated 204  
     cellular 201  
     electric 229-230  
     molecular 204  
     reference 93  
 Adiabatic expansion of the  
     universe 373, 374-377  
 Adiabatic process 212  
 Aerodynamics 158  
 Age of the visible universe ( $A_U$ )  
     349, 356 (341c)  
 Aggregated tangential velocity ( $v_a$ )  
     302-304  
 Alpha decay 328  
 Alternating-current circuit 283  
 Ammeter 260  
 Ampere (A), unit of current 45,  
     226-231  
 Ampere's law 225, 277-283  
 Amplitude (A), 92, 160-162 (50),  
     167, 169, 172-173  
     square ( $A^2$ ) 174 (63a)  
 Angle ( $\theta$ ) 122  
 Angular acceleration ( $\alpha$ ) 122 (18)  
 Angular displacement ( $\Delta\theta$ ) 122 (16)  
 Angular frequency 161  
 Angular momentum ( $L$ ) 125-126  
     (24), 170, 240, 264, 270-271,  
     281, 298-299, 324-325, 329  
 Angular velocity ( $\omega$ ) 122 (17)  
 Anisotropy of the universe 351  
 Antinode 169  
 Antinomy, 214  
     (see also *Russell's antinomy*)  
     of first and second law of  
     thermodynamics 214-215  
 Antiparticles 324-325  
 Archimede's law 125  
 Archimede's principle of  
     buoyancy 158  
 Arc length 122  
 Area 16, 20, 38, 43, 84, 94, 103-  
     104, 124, 126-127, 134, 137-  
     138, 161-162, 167, 174, 180,  
     205, 207  
     (see also *charge*)  
 Area in motion 84, 132, 202  
     (see also *current and charge*)  
 Area under the curve (AUC) 102-  
     103, 117

- Asymmetrical function,  
of Schrödinger's equation 265
- Atmosphere 108, 210
- Atomic magnetic moments 232-233
- Atomic mass unit ( $u$ ) 156, 321
- Average probability amplitude 389
- Average velocity 99, 195
- Avogadro's number ( $N_A$ ) 155, 193
- Axiom, 47, 64  
of conservation of action  
potentials (CAP) 53-58, 83, 95,  
108, 120, 125, 147, 154, 161,  
171, 227  
of equivalence 12, 22-23, 29,  
34-37, 40, 56, 59, 65-67, 70,  
78, 134  
of the reciprocal behaviour of  
the *LRC* of contiguous levels  
in a system 89-90, 91, 140,  
185-186, 198  
of reducibility (AR) 37, 81-85,  
87, 94, 100, 108, 117, 120-  
121, 127-128, 133, 135-139,  
144, 148, 158, 167, 171, 178,  
227  
primary 25, 33-35, 48, 60, 69,  
70, 78, 119, 162, 166, 182,  
227
- Axiomatics 13-15, 20-98
- Axiomatization (see *axiomatics*),
- Balmer series** 295
- Basic photon ( $h$ ) 51, 138, 141,  
144, 146, 150-157, 183, 204,  
206-207, 223, 231-236, 262-  
264, 275, 281, 293-299, 301-  
309, 316-317, 320, 323, 327,  
330, 356, 368-369, 372-373,  
388, 394  
(see also *Planck's constant*)
- BCS theory of superconductivity  
261-265
- Bernoulli's equation 158
- Beta decay 328
- Big bang, 13, 349-350, 354, 357,  
359-376  
hypothesis 13, 357-362, 368-  
374
- Binding energy 320-322
- Biot-Savart law 225, 277-283  
(153)
- Blackbody radiation 73, 183, 192
- Black holes 43, 135, 142, 146,  
240, 285, 358, 361-366, 371,  
373, 391-392
- Bohr magneton 232-233
- Bohr model of atom 231, 293-306,
- Bohr orbit 170
- Bohr radius ( $a_0$ ) 296, 304-305
- Bohr's postulates 295-307
- Bohr's quantization condition 170,  
298-305
- Boltzmann's constant ( $k_b$ ) 193, 195
- Boltzmann's law 193, 194-198,  
200
- Bosons 323
- Boyle-Mariotte's law 192
- Bremsstrahlung spectrum 294-295
- Building of gradients 249-252, 291
- Bulk modulus (B) 168
- Caloric theory** 199
- Calorie, unit of heat energy 200-  
201 (75)
- Calorimetry 201
- Canonically conjugated  
quantities/constituents 41, 46,  
65-66, 79, 92  
(see also *constituents of space-  
time*)
- Capacitance 254-257
- Capacitors, 85, 254-257, 286  
in parallels 257  
in series 257
- Capillarity 158
- Carnot cycle 73
- Carnot efficiency ( $\epsilon_{SL}$ ) 212
- Carnot engine 211-212

- Carnot theorem 211-212  
 CBR-constant ( $K_{CBR}$ ) 207-208  
     (82), 219, 358-359, 360-362  
 Celsius temperature scale 189-190  
 Centre-of-mass 82, 120-121, 124  
     (see also *mass point*)  
 Centre-of-mass reference frame 121  
 Centripetal acceleration ( $a_{ic}$ ) 123 (20)  
 Certain event 32-33, 49, 52, 56,  
     64-67, 69-70, 74, 80, 83, 86,  
     91, 101, 108-109, 124, 132,  
     149-150, 340, 345-346, 372,  
     401  
 Chandrasekhar's equation  
     of finite lifetime of stars 142  
 Change of phase 201  
 Chaos theory 164-165  
 Charge (Q), 223, 226-236  
     fundamental unit of ( $e$ ) 223,  
     231-236  
     of basic photon ( $q_p$ ) 231-236  
 Charging by induction 245  
 Circular motion 56, 92, 99, 108,  
     121, 124-127, 160-161, 172,  
     180, 230-234  
 Circumference, 135  
     of the event horizon ( $S_U$ ) 135,  
     138  
     of the visible universe 135,  
     138, 355 (241)  
 Closed,  
     numbers 33, 54-55, 59, 70, 73,  
     90, 92  
     space-time 23, 26, 28, 31, 33-  
     42, 48-49, 53--65, 71-74, 80,  
     83, 88  
 Coefficient, 54  
     of horizontal energy exchange  
     54  
     of linear expansion 191  
     of vertical energy exchange 54  
     of volume expansion 191  
 Collision, 120  
     elastic 120  
     inelastic 121  
 Collision time ( $\tau$ ) 262  
 Combustion 210  
 Commutative law 60, 68  
 Complex numbers 310  
 Compton scattering 154, 295  
 Compton frequency, ( $f_{c,e}$ ) 51-52,  
     153, 231  
     of proton ( $f_{c,pr}$ ) 157  
 Compton wavelength, ( $\lambda_{c,e}$ ) 51-52,  
     153  
     of proton ( $\lambda_{c,pr}$ ) 157, 323-324  
 Conduction 201  
 Conductivity ( $\sigma$ ) 259  
 Conduction current ( $I$ ) 286  
 Conductor,  
     electric 255-256  
 Consciousness 11-12, 17-27, 30-  
     48, 52, 67-73, 78, 81, 91, 95-  
     96, 98  
 Conservation,  
     of barions 53  
     of charge 53, 245  
     of energy 12, 28, 31, 34-35, 53-  
     54, 60, 65, 70, 73, 83, 89, 93,  
     119  
     of momentum 53, 83, 120, 381  
 Conservative force 117  
 Constant field equation 260  
     (see also *Nernst's equation*)  
 Constants,  
     absolute 53, 384  
     natural 50  
 Constant of proportionality ( $C$ )  
     of Gay-Lussac's law 193 (71)  
 Constituents, 38-39  
     of space-time 39-42  
     reciprocity of 40-42  
     (see also *space-time*)  
 Constructive rule of absolute  
     constants 54  
 Continuousness 33  
 Continuum, 20, 59-75

- of natural integers 59-75, 301-302
- of negative numbers 59-75, 90-91, 218
- of positive numbers 59-75, 90-91, 218
- of transcendental numbers 59-75
- Continuum hypothesis 339
- Convection 201
- Conversion factor 159
- Cooper-pairs 264
- Cosmic background radiation (CBR), 207, 350-351, 375
  - constant of ( $K_{\text{CBR}}$ ) 207-208 (82)
- Cosmological constant ( $k_U$ ), 141 (38a)
  - of Newton's law of gravity 141
- Cosmological constant ( $\Lambda$ ) 143-144 (see also *Einstein's cosmological constant*)
- Cosmological principle 128, 135, 347-348
- Cosmology 347-351
- Coulomb (C), unit of charge 226-236 (see also *square meter* ( $m^2$ ))
- Coulomb constant ( $k$ ) 137, 237-238
- Coulomb force 241-244 (111)
- Coulomb's law 225, 241-246
- Covalent bonding 314
- CPT-theorem 326
- Critical density of the universe 353-356
- Critical temperature ( $T_c$ ) 261
- Cross-sectional area, as charge 181, 202, 258-259, 264, 275
- Current,
  - electric ( $I$ ) 2, 226-231, 257-258, 262-263, 267-268, 271, 274-280
  - thermal ( $I$ ) 202, 205, 217,
- Current element 273, 277
- Current segment 277
- Cutoff wavelength 294-295 (179b)
- Cyclotron, 272-273
  - frequency of 273
  - kinetic energy of 273 (148)
- Dalton's law (law of proportions) 198
- Damping 163
- Dark matter 349
- De Broglie 171
- De Broglie wavelength 308
- De Broglie's wave-particle dualism 100, 299-300, 307 (see also *wave-particle dualism*)
- Deformation ( $d$ ) 113-114
- Degree 189
  - of freedom 30
- Density ( $\rho$ ) 114, 142 (38b), 314
- Derivation rule of absolute constants 364, 377, 387-390
- Diamagnetism 283
- Dielectric constant ( $k$ ) 255-256
- Dielectrics 254 -257
- Differential calculus 31
- Diffraction 171
- Dimension 43
- Dipole moment 280
- Discreteness 28,
  - of space-time (energy) 28
- Disequilibrium 118
- Disharmony 140 (see also *dissipation*)
- Displacement 99, 101-110, 112-118, 225 (see also *motion*)
- Displacement current 278-280, 283-290 (see also *Maxwell's displacement current*)
- Displacement vector 82
- Dissipation 31, 95-96
- Divergence 250-252 (see also *Laplace-operator*),

- Doppler effect 176-177, 235  
 Dot product of vectors 116  
 Drag forces 116  
 Driven oscillations 163  
 Dulong-Petit law 203
- Earth, 145-146**  
   mass of 145-146  
   radius of 145-146  
 Eddy currents 282  
 Efficiency,  
   of thermal energy ( $\epsilon$ ) 210-211 (84)  
 Einstein-de Sitter universe 368  
 Einstein's cosmological constant  
   143-144, 250  
 Einstein's equation of mass and  
   energy 12, 23, 70, 86-88, 128-  
   129, 155, 200, 237, 307, 322  
 Einstein's photoelectric equation  
   294-295  
 Einstein's postulates of the special  
   theory of relativity 342  
 Elastic collision 73, 197  
 Elastic constant ( $p$ ) 114  
 Elastic continuum 157  
 Electric acceleration 239, 246, 394  
   (see also *electric field*)  
 Electric charge 226-231  
   (see also *charge*)  
 Electric circuit 260, 283  
 Electric density ( $\eta_e$ ) 291  
 Electric dipole 244 -245  
 Electric energy 256, 260  
 Electric field, 129, 138, 165, 225,  
   239-240, 241-246, 247-248,  
   296, 304, 308-311, 335, 394  
   Coulomb's law 225, 241-246  
   Gauss's law 225, 249-251  
 Electric-field lines 245, 277  
 Electric flux ( $\phi$ ) 225, 247-248  
   (119), 277  
 Electric force 238, 256, 267  
 Electric potential (V) 252-253 (127),  
   (see also *potential*)  
 Electric power 260  
 Electric resistance 258-259, 275 (152)  
 Electricity 223-225, 226-236  
 Electrodynamics 224  
 Electromagnetic spectrum 292  
 Electromagnetic waves 113, 123,  
   155, 165, 170, 261, 286, 289,  
   291-292, 307  
 Electromagnetism, 223-225, 228-  
   229, 232-240, 247-251, 260,  
   266-271, 277-287, 291  
   four equations of 225, 237, 276  
 Electromotive force (*emf*) 226-231  
 Electron, 110, 153-156, 170-174,  
   183, 196, 204  
   mass of 153 (45)  
   orbit 171  
 Electron spin 170, 265  
 Electronvolt (eV), unit of energy  
   235, 319-320  
 Electrostatic potential energy 254-257  
 Electrostatics 224, 247  
 Elementary action potential  $E_A$  28-  
   40, 48, 52-53, 151, 154, 169,  
   173, 231  
 Elementary particle 16, 28, 42, 53,  
   79, 94-96, 144, 150, 153,  
   170, 173, 187, 204, 232, 240,  
   262, 273, 285, 303, 308  
 Emissivity ( $e$ ) 205  
 Energy (exchange), 12, 27-40, 45,  
   48, 53--55, 60-63, 71-76, 81-  
   86, 92-98, 116-121,  
   horizontal 28  
   vertical 28  
   (see also *primary term*)  
 Energy density in electromagnetic  
   waves ( $\eta_e$ ) 257 (134), 291  
   (173)  
   (see also *electric density*)  
 Energy interaction 19, 27, 37, 49,  
   57-58, 71, 81, 95  
   (see also *energy exchange*)

- Energy potential/gradient 117, 143, 220, 250  
(see also *potential/gradient*)
- Entropy ( $S$ ), 208-217 (85)  
change in ( $\Delta S$ ) 213 (85)  
(see also *second law of thermodynamics*)
- Equilibrium, 118-119, 147, 160  
thermal 189-191
- Equipartition theorem 203
- Equivalence,  
(see also *principle of last equivalence* and *axiom of equivalence*)  
of mass and energy 12, 23, 87  
(see also *Einstein's equation*)  
of SI units 252-253
- Escape velocity ( $v_e$ ) 181, 363
- Eschatology of science 40, 71
- Ether 110, 336-337
- Euclidean space 19, 333-334
- Euler's method 116
- Event horizon, 135  
of big bang 370, 373  
of black holes 142  
of the visible universe 134-135, 138, 141, 352 (237), 355 (241), 358-360, 366, 394
- Evolution Law 96-98
- Expansion of the universe 138-139  
(see *standard model of cosmology*)
- Exponential calculus 163, 293
- Exponential laws 217, 312
- External time ( $f_{ex}$ ) 301-304
- Extrinsic tangential velocity ( $v_{ex}$ ) 302
- Factor of damping ( $Q$ ) 163
- Fahrenheit temperature scale 191
- Farad ( $F$ ), unit of capacitance 254-255
- Faraday's law 225, 277-283
- Fermi-Dirac statistics 234
- Fermi energy 264
- Fermi solution 158
- Fermions 234, 323
- Ferromagnetism 283
- Feynman, R. 62
- Field, 12, 21, 87, 111, 113, 338  
(see also *LRC*)  
electric (see *electric field*)  
gravitational (see *gravitational field*)  
magnetic (see *magnetic field*)
- Fine structural constant of gravitation ( $K_G$ ) 393
- First law of thermodynamics 190, 199-205
- FitzGerald's length contraction 339-340, 344
- Fluids 157-158
- Focus of ellipse 126, 179
- Force, 19, 41, 44, 79-80, 88, 99, 105-108, 116-118, 123-124, 128, 138, 157  
conservative 117  
definition of 41, 99, 115-116, 134, 147  
dissipative 117  
restoring 109, 112-114, 118  
(see also *Hooke's law*)
- Force constant 110, 114, 121
- Formalism, 12, 20  
geometric 43, 52, 81-84  
mathematical 12-13, 20-25, 32-37, 43-44, 48, 51-52, 60, 65, 69, 71, 76, 80, 91
- Foundation crisis of mathematics 14, 20-21, 63
- Fractal space 38
- Free fall 108, 120-121, 131-135, 145, 161, 163, 169, 171-177, 183-186, 196, 207, 219
- Freezing point 189
- Frequency ( $f$ ) 30, 32, 38, 43, 46, 51, 91, 104, 153, 160-161  
(see also *absolute time*)
- Friction 116
- Friedmann's model of the universe 353-355

- Function 33
- Fundamental constants 16, 111, 389, 394-395
- Fundamental mode of vibration 169
- Fundamental unit of charge ( $e$ ) 223, 231-236
- Fourier-analysis 159, 261  
(see also *harmonic analysis*)
- Fusion 201
- Galaxy** 186, 270, 351
- Galilei, Galileo 379
- Galilei's experiment 381-386
- Gauss's law, 225, 246-248  
of magnetism, 225, 277-283
- Gay-Lussac's law 203
- General continuum law 111, 112-115
- Generalized work-energy theorem 121
- Generators 282
- Geometry 20, 23, 36, 39, 40, 62-63, 70, 82, 85, 93-94
- Gibbs-Donnan equilibrium 260
- Gödel, K. 20, 63  
first theorem 14, 20, 34, 63, 72  
primary statements 20, 23, 35
- Gradient 37, 86, 143, 184, 199, 220, 249-250, 252, 256, 319,  
(see also *potential* and *LRC*)
- Gravitation, 12-13, 16, 42-45, 54, 79-80, 87, 99-116, 126-129  
mechanism of 178-187
- Gravitational acceleration ( $g_u$ ) 129-130, 365, 371
- Gravitational constant ( $G$ ) 127-128, 130-138, 145-146
- Gravitational field 129, 178, 342, 359, 365, 371  
(see also *gravitational acceleration*)
- Gravitational mass 128, 131  
(see also *mass*)
- Gravitational potential 80, 87, 129, 142, 148, 252, 342, 357, 364-365, 371
- Gravity, law of 21, 54, 102, 105, 111-114, 126-137, 140-145  
(see also *Newton's laws*)
- Growth laws 245
- GUT (grand unified theory) 17, 79
- Hadrons** 320-322
- Hadronic forces 27, 42, 320
- Hall effect 274
- Hall voltage ( $V_H$ ) 274-275
- Harmonic analysis 159  
(see also *Fourier-analysis*)
- Harmonic synthesis 159, 261
- Harmonic waves 166-167, 175
- Harmony 163, 164, 167  
(see also *resonance frequency*)
- Heat ( $Q$ ), 88, 199-205 (75)  
capacity 200  
engines 204  
reservoir 210-211
- Heisenberg uncertainty principle 102, 307, 315-318, 336, 369, 396
- Henry ( $H$ ), unit of inductance 282
- Hertz ( $Hz$ ), unit of frequency 160-161
- Hilbert 13
- Hologram 292
- Homogeneity 21, 28, 33
- Hooke's law, 109-112  
contact forces 109-110  
restoring force 110
- Hot expanding hypothesis 347-351, 357  
(see also *standard model of cosmology*)
- Hubble constant ( $H_0$ ) 349, 355
- Hubble Space Telescope 145
- Hubble time 349
- Hubble's law 348-352

- Humidity, relative 198
- Hydrogen atom,  
in Bohr model 295-298, 321
- Hydrogen spectrum 295
- Ice-point temperature 111, 189
- Ideal blackbody 206
- Ideal gas 191, 195
- Ideal-gas law 191-195
- Impulse ( $I$ ) 120, 316, 318, 320
- Induced current 279
- Induced emfs 279
- Induced potential 279
- Inductance, 282  
mutual 282  
self- 282
- Inertia, 106, 335  
law of 343-344
- Inertial reference frame 78, 106-107
- Inhomogeneity of space-time 28,  
33, 35, 40, 48
- Initial conditions 101-102
- Initial-value problem 101-102, 315
- Infinite, 27  
great number 66-67  
small number 66-67  
space-time 30
- Inner energy 117
- Input-output model  
of the universe 14, 364, 387-394
- Insulator 245
- Integers, 34, 74, 169, 298, 304,  
306, 323  
continuum of 223, 301-305  
(see also *numbers*)
- Integral calculus 31, 299
- Integration 15, 35, 101, 103, 136,  
150, 152  
(see also *integral calculus*)
- Intensity of waves ( $I$ ) 168
- Intensity level of loudness 168
- Interference, 167-168  
(see also *superposition*)  
constructive 167, 169, 170-171  
destructive 167, 181
- Internal energy 199
- International Bureau of Weights  
and Measures 45, 80
- Intrinsic action potential,  
of electron 300
- Intrinsic angular momentum ( $L_{in}$ )  
300 (186)
- Intrinsic tangential velocity ( $v_{in}$ )  
302 (189a)
- Inverse-square laws 243-244, 306
- Irreversible process 212, 214-215
- Isobaric expansion 191
- Isotherm 194, 198, 214
- Isothermal expansion 212
- Jet propulsion 121
- Joule (J), unit of energy 36, 93,  
127, 201, 319, 321-323, 331
- Kelvin (K), unit of temperature  
168, 191, 216
- Kelvin-Planck statement of second  
law of thermodynamics 211
- Kelvin temperature scale 191, 216
- Kepler's laws 126-128
- Kilogram ( $kg$ ), unit of mass 45, 80,  
149, 151
- Kinetic energy, 93, 108, 117, 120-  
121, 125, 161, 184, 195-198,  
200, 203-206  
average 110, 195 (73), 203
- Kinetic theory of gases 194-198
- Kirchhoff's rules 260
- Kolmogoroff's axiomatics,  
of the theory of probability 63,  
65  
primary axioms of 63, 65
- Laplace-operator 242-252
- Law,  
of conservation of charges 245  
of conservation of momentum 83  
of energy 19, 199

- of entropy  
(see *second law of thermodynamics*)
- of radiation 205-208
- Length contraction 339-340, 344  
(see also *FitzGerald's length contraction*)
- Lenz's law 282
- Levels of space-time 16, 25-71,  
80, 85-87, 90-94, 98
- Lever arm ( $l$ ) 123
- Light, 45, 83, 106, 111, 157, 165,  
177, 220, 294, 336-338, 350,  
357, 367  
speed/velocity of ( $c$ ) 41, 45-46  
51, 111, 113, 129, 134-136,  
138 (37a) 146, 152, 196, 207,  
302-303, 338-342, 351, 360,  
368, 371, 385-388, 391-392  
(270), 394-395,
- Linear charge density 246-247
- Linear density of mass ( $\rho$ ) 114
- Linear eccentricity 179
- Linear motion 99, 121-122, 125
- Logic 34, 60, 133, 140, 390
- Logos 18, 34, 139, 203, 397
- Long range correlation, *LRC* 21,  
85-91, 129, etc.  
(see also *gradient* and *potential*)
- Lorentz factor ( $\gamma^{-1}$ ) 88, 340, 344
- Lorentz force 269
- Lorentz transformations 88, 340,  
344, 345-346
- Lussac's law 193
- Lyman series 295
  
- Mach principle** 348
- Magnetic density ( $\eta_m$ ) 291 (175)
- Magnetic energy 282
- Magnetic field 95, 165, 225, 267-  
273, 277-280, 315, 392
- Magnetic field length ( $l_{\mu_0}$ ) 239-240  
(110) 371, 391, 394
  
- Magnetic field lines 271
- Magnetic flux ( $\phi_m$ ), 278-279 (155)  
quantum ( $\phi_m$ ) 266 (142)
- Magnetic force ( $F$ ) 269-270 (143),  
274
- Magnetic induction 279
- Magnetic moment ( $m$ ) 232-233.  
271, 280-282
- Magnetisation ( $M$ ) 282
- Magnetism 223-225, 267-273
- Mass ( $m$ ), 12, 16, 23, 44-45, 69,  
75, 79-81 (41-1), 84-87, 104-  
108, 115-116, 120, 124, 127,  
146-151  
at rest 27, 56, 88  
defect 322  
density ( $\rho$ ) 143  
of the basic photon ( $m_p$ ) 151-157  
of the earth 145-146  
of the visible universe 353-355  
of neutrinos 327-331  
particle 23, 153  
(See also *centre-of-mass*)  
Per unit length ( $\mu$ ) 166 (54)  
point 23, 82, 84, 99, 101  
(see also *mass particle*)  
relativistic 16, 70, 86, 88, 344-  
346
- Mass-to-charge ratio 271-272
- Mathematics 12-98
- Matter 12, 14, 16, 27, 70-74, 80,  
93, 106, 110-113, 124, 131,  
139, 143-145, 151-157
- Maxwell-Boltzmann energy  
distribution function 195-196
- Maxwell's displacement current  
( $I_d$ ) 225, 283-290 (164)
- Maxwell's equations of electro-  
magnetism, 225, 236, 283-290  
differential form 288-290  
integral form 287-288
- Mayer, J.R. 190
- Mean speed 262

- Mechanical energy 119  
 Mechanical theory 199  
 Mechanics 99-104  
 Meissner-Ochsenfeld-effect 266  
 Mesons 323-324  
 Meter ( $m$ ), unit of distance 136, 145  
   square ( $m^2$ ) 16, 84, 231, 254  
   (see also *coulomb*)  
 Method, 16, 32, 36, 42, 58, 62, 71, 76,  
   empiric 36  
   formalistic 20, 42-44, 69  
   of definition 43-50, 57, 85-86, 92, 95, 98, 147  
   of measurement 35-57, 62, 68, 77-86, 92-95, 147-148  
   statistical 57-58, 62-63, 68  
 Methodology of science 19, 22, 47  
 Michelson interferometer 292  
 Michelson-Morley experiment 110, 337-338  
 Millikan's oil-drop experiment 224  
 Minkowski world 19, 62  
 Molar heat capacity ( $C_m$ ) 203 (78)  
 Molar mass, 156, 168, 321  
   of hydrogen ( $M_H$ ) 156 (46b)  
 Mole ( $mol$ ), unit of substance 155  
 Molecular orbit 314  
 Mol-level 155-156, 193  
 Momentum ( $p$ ) 81-84, 286-287  
 Moment of inertia ( $I$ ) 124 (22)  
 Mössbauer effect 164  
 Mother-child paradox 367  
 Motion (displacement), 37, 39, 47, 63, 82, 84, 92-93  
 Motors 282  
 Murray Gell-Mann 62  
  
 Nabla-operator 248-252  
 N-body-problem 126  
   (see also *three-body-problem*)  
 Negentropy 220  
 Nernst's equation 260  
 Neutrinos, 327-331  
   electron-neutrino 330  
   myon-neutrino 330  
   tauon-neutrino 330  
 Neutron, 153  
   mass of 153-154  
 Neutron stars 240, 391  
 Newton, Isaac 63, 99, 113, 333-335  
 Newton ( $N$ ), unit of force 147, 152 (128b)  
 Newton's laws, 105-109  
   first law of motion 105  
   law of gravity 105, 128-132, 242  
   law of inertia 107  
   second law of motion 105  
   third law of motion 105  
 Node, 169  
   of standing wave 169-170  
 Nuclear forces 42  
   (see also *hadronic forces*)  
 Nuclear magnetic resonance (NMR) 315  
 Numbers, 15-16, 20, 22, 29, 33-34, 38, 41-42, 51  
   complex 34  
   irrational 34, 385  
   rational 34  
   real (closed) 33, 42, 71-73  
   transcendental (open) 14, 34, 42, 71-73  
 Numerical eccentricity ( $\epsilon$ ) 179  
 Numerical methods 16  
  
**Ohm** ( $\Omega$ ), unit of resistance 258-259, 276  
 Ohm's law 258-259  
 Ohmmeter 260  
 Orbit of planet 126-127, 179-186  
 Oscillations, 159-164  
   damped 162  
  
**Parallel-axis theorem** 125  
**Paramagnetism** 283

- Paschen series 295  
 Pauli 329  
 Pauli exclusion principle 233-234, 265, 323  
 Pendulum 164  
 Percents 198, 199  
 Period (T), 164  
   of attraction 180-182  
   of repulsion 180-182  
 Permeability of free space ( $\mu_0$ ) 136, 224, 228-229, 236-240  
 Permittivity of dielectrics ( $\epsilon$ ) 255-256  
 Permittivity of free space ( $\epsilon_0$ ) 136, 224, 236-240, 255-256  
 Perpendicular-axis theorem 125  
 Phase change 201  
 Phase constant ( $\delta$ ) 168  
 Photoelectric effect 293-294  
 Photoelectric equation of Einstein 294-295  
 Photon level 16, 26, 41, 45-51, 70, 86-88, 102, 105, 108, 111, 113, 129-134, etc.  
 Photon space-time 47, 178-187, 289  
 Photons 12, 16, 30, 46, 82, 88, 183-187, 196, 205-210, 220, 234, 291, 294-298, 305, 309, 311, 317, 322, 324-325, 328  
   energy of 12, 312  
   frequency of 46, 185  
 Photosynthesis 210  
 Physical constants 13, 16, 53, 152  
   (see also *constants of nature*)  
 Physical probability space 55, 57, 344, 346  
 $\pi$  ( $\pi$ ), transcendental number 42, 121, 138, 151, 161, 166, 293-294  
 Planck's constant ( $h$ ) 51, 149  
   (see also *basic photon*)  
 Planck's equation of photon  
   energy 12, 151, 294-298 (178) 307  
 Planck's parameters, 361, 368-374  
   Planck's length ( $l_{pl}$ ) 368-374 (254)  
   Planck's mass ( $m_{pl}$ ) 368-374 (249)  
   Planck's time ( $t_{pl}$ ) 368-374 (258)  
 Poisson equation 251 (124)  
 Potential 86 (43-1), 87, 129, 138, 140, 252  
   (see also *gradient* and *LRC*),  
 Potential difference ( $\Delta V$ ) 252, 258  
 Potential energy 117, 120-121, 161, 248  
 Potential energy function 252 (126)  
 Power ( $P$ ) 119, 208 (83)  
 Power laws 245  
   (see also *growth laws*)  
 Poynting-vector 291-292  
 Pressure ( $P$ ), 158, 191 (68), 192-194, 198, 202, 212-213, 216  
   radiation 292  
 Primary term 12-17, 20, 43  
 Principle, 11-12, 17, 20, 22  
   cosmological 128, 135  
   of causality 57-59  
   of circular argument (PCA) 23, 25, 29, 31-34, 37, 43-50, 53-56, 60  
   of equivalence 342-343  
   of last equivalence (PLE) 23-25, 28, 33, 40, 47-54, 60-61, 65-70, 73-74, 84, 132, etc.  
   of relativity 341-342  
   of similarity 129, 156  
   of simultaneity 336, 341  
   of superposition 55, 167, 198, 261, 287  
 Probability, 48, 55-58, 314-319  
   set (physical) 16, 33, 47, 51-57, 58-75, 216, 309, 315, 345-346  
   theory of 309, 318  
 Probability density, 142, 176  
   of particles 176  
   (see also *Schrödinger's wave equation*)

- Proof of existence 20-21, 59, 66, 111, 133, 229, 310, 315
- Proton, 26-28, 42, 52, 153, 157, 173, 183, 196, 204, 220, 229, 310, 315, 320  
mass of ( $m_{pr}$ ) 142, 153-154, 156
- QCD, quantum chromodynamics 62, 390
- QED, quantum electrodynamics 62, 389
- Quality factor (*Q factor*) 164
- Quants 26, 64
- Quantization of energy 26, 295
- Quantum mechanics 293-332
- Quantum Hall effect 274-276  
(see also *Hall effect*)
- Quantum number(s), 301-306  
of angular momentum ( $l$ ) 302  
magnetic ( $m$ ) 302  
primary ( $n$ ) 302, 305
- Quarks 42, 79, 110, 223, 236, 273, 308
- Quasars 240
- Quotient ( $K_{1,2}$ ) 387  
(see also *absolute constants*)
- Rad** (*radiant*), unit of angular displacement 122, 167
- Radiation, 183-184, 201, 205-208, 210  
power of ( $P$ ) 183, 205  
laws of 205-209, 219
- Radius,  
of the earth 145-146  
of the visible universe ( $R_U$ ) 137 (34), 349-352, 355
- Range of frequencies 316
- Rayleigh-Jeans law 170, 293
- RC-circuit 260
- Reciprocal behaviour, 42  
of gradients (*LRC*) 42, 90-91, 108, 140, 185, 248  
of space-time 42-43, 66, 180, 186, 198, 218,
- Redshift 177, 362, 363-365, 366, 375
- Redshift-distance relation 363
- Reference,  
frame 82  
(see *inertial reference frame*),  
system 29, 45-47, 49-51, 55-58, 80, 87, 89, 93, 95, 174, 224  
mass 80  
unit 29, 55, 57
- Reflection 171
- Refraction 171
- Refrigerators,  
second law of thermodynamics 211-212
- Relativistic (change of), 51, 164, 180-182, 185, 190, 278, 304, 324, 339, 344, 364  
energy 51, 81, 184, 320, 331, 344-345 (231), 346, 384 (262)  
momentum 81, 344, 385  
mass 16, 51, 70, 81, 86, 88, 320, 344, 345-346  
space 46, 51, 184-185, 340, 344, 363  
time 46, 51, 184-185, 340, 344
- Residence probability density  
of the photon 309, 313
- Resistance,  
electric ( $R$ ) 203, 258-259, 261-265  
thermal 203
- Resisters,  
in parallel 260  
in series 260
- Resistivity ( $\rho$ ) 259-260 (139), 262-265
- Resonance frequency 163, 173
- Rest energy 320-322, 323
- Rest mass 320-322, 323, 345-346
- Rest time 344

- Resting membrane potential 201
- Restoring force  
(see *force*)
- Resultant force 105
- Rev (revolution), unit of angular displacement 122
- Reversible process 212-215
- Reversibility of time 102-103
- Right-hand rule 269
- Right-triangle theorem 384 (262)
- Root mean square speed 196-198 (74a)
- Root mean square velocity ( $v_{\text{rms}}$ ) 262-265
- Rotation(s) 121-125, 159-163, 170-174, 179-181, 186, 295-299  
(see also *circular motion*)
- Rotational kinetic energy 125
- Rotational work ( $dW_i$ ) 125 (23)
- Rule of differentiation 250-252
- Rule of three (RT) 12, 33, 35, 48
- Russell's antinomy 14, 72, 400
- Rydberg constant 295
- Rydberg-Ritz formula 295-307
- Scalar 103-104, 116, 146
- Scales 147-148
- Schrödinger's wave equation, 62, 172, 307-314  
time-dependent 310-312  
time independent 310-311
- Schubnikov phases 266
- Schwarzschild radius ( $R_s$ ) 364-365 (245), 391
- Second-law efficiency 212
- Second law of thermodynamics 208-217
- Second (s), unit of conventional time ( $t$ ) 46, 55
- Set, 305  
of cardinal numbers 305  
of ordinal numbers 305  
Russell- 26
- Sharpness of resonance 164
- Simple harmonic motion 160
- Sine-cosine function 160
- SI system 16, 29, 42, 44-48  
50-55, 78,
- SI units 16, 44-48, 51, 57, 70-71, 80, 84
- Solenoid 230, 277, 282
- Solids 157-158
- Sommerfeld's constant of fine structure 142, 388-391
- Sound waves 171
- Space, 16, 19, 21, 25, 36, 38-39, 41, 43, 45-56, etc.  
(see also *constituents of space-time*)  
one-dimensional 39, 51, 56  
two-dimensional  
(see *area and charge*)
- Space-time, 13, 15, 21-50, 98  
one-dimensional 31, 38-41, 46, 48, 51, 81, 84  
(see also *velocity*)  
two-dimensional 84  
(see *energy*)
- Space-time symbolism 13, 39, 68-69  
(see also *primary term and energy*)
- Special theory of relativity 271, 293, 336-339, 342  
(see also *theory of relativity*)
- Specific constant ( $C$ )  
of Kepler's third law 127
- Specific heat ( $c$ ) 200, 204 (79a)
- Speed (see *velocity*)
- Spin 170, 234, 264
- Spring
- Square time ( $f^2$ ) 110, 123, 143-144, 173, 250-252, 254  
(see also *divergence*)
- Square time law of structural complexity ( $K_s$ )  
(see *Evolution Law*),

- Standardisation condition 176, 313
- Standard model, 79  
 of physics 79, 124, 136, 225, 273, 303, 323-329  
 of cosmology 13, 16, 132, 141, 208, 327, 347-363, 366-371, 376
- Standing wave 163, 169-171, 299-300, 315
- Stankov's constant ( $k_s$ ) 219 (91)
- Stankov's law of photon thermodynamics 184, 208, 217-221 (92)
- Stationary states of Bohr model 27, 295-298
- Statements,  
 empirically verifiable 26-98  
 intuitiv-formalistic 25
- Statistics 36, 47, 54-59, 63-66, 96, 274, 299, 303, 309-313, 318
- Steady state-models 351
- Steam engine 192
- Stefan-Boltzmann law 183, 201, 295-208 (80)
- Stefan's constant ( $\sigma$ ) 205
- Stoke's integral theorem of  
 Ampere's law 225, 277-283 (155a)
- Stopping potential of photoelectric effect 294
- Strain 158
- Structural complexity ( $K_s$ ) 55, 91-97, 132-137, 141, 146, 162-167, 173, 202, 207, 223, 231-236, 254-256, 264, 281, 284, 326  
 $K_s$  in motion 70, 109, 117, 124-127, 202  
 (see also *current* and *area*)
- Sum over the histories (QED) 62, 389
- Superconductivity 158, 261-265
- Superconductor energy gap 266
- Superimposed rotations 159, 167, 170-171, 299-307
- Superimposed waves 159, 170-173, 181, 290  
 (see also *superposition*),
- Superposition, 55, 167  
 principle of 55, 167, 198, 261  
 (see also *interference*)
- Surface charge density 246-247
- Surface tension, 158  
 coefficient of 158
- Surplus energy 330, 337
- System, 11- 17, 20, 23, 26, 28  
 axiomatic 20, 22-23  
 basic 28  
 categorical 11, 16-17  
 of space-time 25-33
- Symmetry, 326  
 CPT-symmetries 326
- Tangential velocity ( $v_{it}$ ) 123, 302-303
- Temperature 188-191
- Temperature gradient 199, 202
- Temperature scale 30, 32, 33  
 Celsius 31
- Tensile force 157-158
- Tensile stress ( $\sigma$ ) 157-158, 257
- Tension ( $T$ ) 158
- Tesla ( $T$ ), unit of magnetic field 269-270
- Test charge 238, 241
- Theory of relativity, 13, 21, 23, 39, 42-46, 51, 62, 78, 81-82, 88-89, 106-107, 143, 147, 150, 152, 271, 293, 303, 320, 336-340, 341-350, 357, 362, 365  
 general 19, 21, 336, 341-344, 357
- Theory of sets 20, 23, 29, 34, 59-64, 72, 94, 315, 318, 366
- Thermal conductivity 205
- Thermal contact 188
- Thermal current ( $I$ ) 202, 205, 217
- Thermal energy 199-205, 210-216
- Thermal equilibrium 189-190
- Thermal expansion 191, 204
- Thermal gradient ( $I$ ) 184, 202 (76)
- Thermal resistance ( $R$ ) 203-205
- Thermodynamics 190, 199-205

- Thermodynamic level, 189, 195, 197, 200, 203, 213-215, 219  
of photon space-time 219-220  
of matter 190-192, 195-200, 203-204, 209, 213-218, 220
- Thermometer 189-190, 196, 214
- Third law of thermodynamics  
(Nernst's theorem of heat) 216
- Three-body-problem 126
- Threshold frequency 294
- Threshold wavelength 294
- Time, 31-32, 41-46, 50, etc.  
absolute ( $f$ ) 31  
(see *absolute time*)  
conventional ( $t$ ) 38, 44-51, etc.  
dilution 340, 344  
(see also *Lorentz transformations*)
- Time constant ( $\tau$ ) 162 (53a)
- Toroid 278 (154a)
- Torque ( $\tau_i$ ) 123-124 (21), 271
- Total energy 161
- Translation 121  
(see also *motion, linear*)
- Triple point of water 191
- Ultraviolet catastrophe 170, 293  
(see also *Rayleigh-Jeans law*)
- Universal action potential ( $E_{AU}$ )  
130, 131-132 (30), 146, 353, 372, 395
- Universal equation (UE) 16, 28, 32-35, 48-53, 61, 75-76, 84- 86, 94, 97, etc.  
(see also *Universal Law*)
- Universal equation of gravitation  
114, 142 (38b)
- Universal field equation 336, 365
- Universal gas constant ( $R$ ) 168, 194
- Universal gravitational  
acceleration( $g_U$ ) 129-137 (27b)  
constant ( $G$ ) 127-131 (29) 135-136 (33), 238-239  
(see also *gravitational constant*)
- Universal Law 12-18, 22, 28, 32 (18-1), 35-39, 44-50, 53, 60-61, 69, 75, 84-97, etc.  
(see also *universal equation*)
- Universal photon time ( $f_U$ ) 391-392 (268)
- Universal potential ( $U_U$ ) 41, 89 (43-5), 129, 138
- U-sets 4-9, 23, 33, 37, 49, 53, 60, 72, 75-76, 81, 94
- Vacuum 16, 21, 26, 35, 95, 106-107, 111-115, 165, 178, 192, 195, 218, 309, 313, 316, 338-342, 357, 372, 401
- Van der Waals equation 198
- Vector 38, 82, 84, 87, 103-104
- Vector-scalar-rule 103-104
- Velocity ( $v$ ), 37-41 (21-1), 45, 63, 68 (37-3), 81-88, 92-93, 99, 100-103, 105-106, 113-120, 134, 155, 159, 161, 166, 168, 170, 173, 195-196, 207  
angular 122 (17), 161  
average 99, 193, 195-196  
circular 115  
definition of 99  
escape 134, 181-182, 184-185  
instantaneous 99 (2), 100  
of attraction ( $v_a$ ) 182, 185  
tangential ( $v_{it}$ ) 123 (19), 181-182
- Venturi effect 158
- Vibrations 92, 111, 167  
(see also *oscillations*)
- Violet-shift 177
- Visible universe 134-142, 145, 179, 349-367, 372-376, 394
- Voltage 232, 263
- Volt ( $V$ ), unit of electric potential  
252 (128)
- Voltmeter 260
- Volume charge density 246-247
- Von Klitzing constant 275-276

- Watt (W)**, unit of power  
**Wave equation** 12, 92-93, 109, 111, 113, 142, 144, 170, 172-176, 234, 248, 257, 283-284, 290-294, 308, 311, 316, 337-338  
 (see also *Schrödinger's wave equation*)  
**Wave function** 283-284, 309  
 (see also *wave equation*)  
**Wavelength ( $\lambda$ )** 38, 138, 141, 152-153, 166, 173, 232-234, 285, 293, 295, 302-303, 308, 325  
 of maximal radiation ( $\lambda_{\text{max}}$ ) 183, 207, 308  
 (see also *Wien's displacement law*)  
**Wave number ( $k$ )** 166 (55)  
**Wave packet** 170, 173-175, 315  
**Wave-particle dualism** 70, 93, 100, 109, 155, 159, 163, 171, 173, 284, 299, 307, 314  
**Wave theory** 12-13, 62, 91, 159-161, 166-171, 175-176, 181, 187-188, 196, 265, 269, 283-284, 299, 315, 324, 336  
**Waves**, 159-164  
     mechanical 165-168  
**Wave velocity** 168  
**Weak nuclear forces** 124  
**Weber (Wb)**, unit of magnetic flux 282  
**Weight** 147-150  
**Weight density** 158  
**White dwarfs** 240  
**Wien's displacement law** 183, 196, 201, 205-208, 293  
     constant of proportionality B 196, 207 (81a)  
**Work (W)** 116-121, 203  
**World line**  
 (see *event horizon*)
- X-rays** 294-295, 308  
**Young's modulus (Y)** 158  
**Zeroth law of thermodynamics** 189  
**Zero**, 59  
     -set 95  
**Zero point energy** 318  
**Zirkelschlussprinzip** 29  
 (see also *principle of circular argument*)