THE NEW INTEGRATED PHYSICAL AND MATHEMATICAL AXIOMATICS OF THE UNIVERSAL LAW[1]

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ABSTRACT

In 1995, I discovered the **Universal Law** (the **Law**) of Nature: I proved that all known physical laws and their applications can be derived from this one law within **mathematical formalism** and can be explained for the first time from an epistemological and cognitive point of view. The discovery of the Law is the logical result of the consistent implementation of the principles of mathematical formalism to the structure of present-day physics. This endeavour has led to the development of a **unified theory of physics and cosmology**, which is a full **axiomatisation** (**axiomatics**) of physics. It could be shown that physics is applied mathematics to the physical world. The major results of the new theory are: All terms, quantities, constants, and other physical magnitudes can be axiomatically derived from the **primary term, energy = space-time,** which is the primary term of human consciousness. The **primary axiom** of the new axiomatics establishes the semantic and mathematical equivalence between all words or abstract symbols that can be arbitrarily used for the primary term. This is called the „**principle of last equivalence**"; it is the

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first and only *a priori* axiom of the new **integrated physical and mathematical axiomatics**. According to it, energy (space-time) is closed, infinite, continuous, inhomogeneous (discrete), and constant; it is in a state of permanent energy exchange. It can be proven that the continuum (the set of all numbers) is equivalent to the primary term. Therefore, it is the common basis of both physics and mathematics. The new axiomatics is verified by all mathematical (numerical) results that have been theoretically or experimentally obtained in physics so far. However, it eliminates some fundamental formalistic blunders that have been introduced in this natural science throughout its history by implementing the principles of mathematical formalism in a inconsistent, and hence, wrong manner. In this way, the validity of mathematics as challenged by Gödel's theorem can be proven in the real world (proof of existence). This eliminates the continuum hypothesis and the ongoing foundation crisis of mathematics as artefacts that are based on wrong assumptions.

The Universal Law describes space-time in mathematical terms. The **universal equation** is $E = E_A f$, where E is **energy exchange**, E_A is a specific constant amount (quantum) of exchanged energy, called "**action potential**", and $f = E/E_A$ is called „**absolute time**". The latter is a dimensionless quotient. The Universal Law is a **law of energy**. Energy (space-time) is the only real thing. All physical quantities such as mass, charge, force, and momentum are abstract subsets of space-time that are first defined within mathematics (objects of thought) and are then measured in the real world. They are dimensionless numbers that belong to the continuum. Since they contain space-time as an element (U-subsets), they can be axiomatically derived from the primary term. For instance, it can be proven in an irrevocable manner that *mass*, as it is currently defined in physics, is actually a synonym for *energy (space-time) relationship*, and *charge* is a synonym for *area* (two-dimensional space), that is, the SI unit 1 *coulomb* is equivalent to $1m^2$. Therefore, photons are not mass-less particles, as is believed in physics today, but exhibit energy relationships (masses), just as all other

2

material systems such as gravitational objects. By eliminating such fundamental formalistic blunders in physics, gravitation can be integrated for the first time with the other three fundamental forces. At the same time, it can be cogently proven that the big-bang-hypothesis, and hence all the basic concepts of modern cosmology, are entirely wrong. The new theory is outlined in two comprehensive volumes of more than 1000 pages and encompasses the full axiomatic presentation of the fundamental physical disciplines. The present publication summarizes the basic axioms and conclusions of the new integrated physical and mathematical theory of the Law.

Key words: Universal Law, universal equation, primary term, space-time, energy, integrated physical and mathematical axiomatics, mathematical formalism, space, absolute time *f*, primary axiom, continuum, probability set, epistemology of mathematical equations.

1. INTRODUCTION

Since Einstein, it has been the dream of many physicists to discover the „universal field equation" and derive all known laws from same. Contrary to this endeavour, modern physics teaches that nature is regulated by many distinct physical laws. They are products of various disciplines, such as classical mechanics, thermodynamics, wave theory, electromagnetism, quantum mechanics, theory of relativity, QED, QCD, etc. We encounter various laws, the most prominent of which are: Newton's axioms of classical mechanics, his law on gravity, Kepler's laws, the first and second law of thermodynamics, Boltzmann's law, laws of radiation (Wien's displacement law, Stefan-Boltzmann's law), classical wave equation, various laws of electricity and magnetism, which can be regarded as precursors of Maxwell's four equations of

electromagnetism, Schrödinger wave equation of quantum mechanics, etc. Unfortunately, physicists have failed to explain why Nature needs so many laws, and how it co-ordinates them in a simultaneous manner, so that it functions as an ordered whole. The new axiomatic approach in physics proves that these different laws are, from ontological point of view, equivalent mathematical presentations of one single law of nature - they are derivations of the **Universal Law** for specific energy interactions. This extensive proof forms the basis of the new unified theory of physics and cosmology, which adheres to the principles of mathematical formalism (see Tables 1 & 2).

Although the necessity of axiomatizing physics on the basis of mathematical formalism was postulated some time ago (1), this target has not yet been achieved. The discovery of the Universal Law of Nature has led to the establishment of a general theory of physics and cosmology, which is an axiomatization of physics on the basis of mathematical formalism (2-5). It confirms without any exception all the mathematical (theoretical) and experimental results obtained in physics so far. At the same time, it reveals that some basic verbal interpretations of these results are essentially wrong from an epistemological point of view. Such mistaken conclusions have precluded the unification of physics. The major results of the new integrated physical and mathematical axiomatics can be summarized as follows:

1. Energy (space-time) has only two dimensions (constituents), space and absolute time**.** They are canonically conjugated reciprocal magnitudes that can be expressed as numerical, dimensionless relationships. All physical quantities as measured by the SI system can be derived from these two quantities (see Table 2). This proves that the SI system is an anthropocentric surrogate and should be abolished from theoretical physics.

4

2. There is no vacuum. There are instead photons (photon level) perceived as space (extent). The photon level has the same properties as matter, for instance, it can be assessed in terms of mass (space-time relationship) and charge (area). Two new fundamental constants have been derived: mass $m_p = 0.737 \times 10^{-50}$ kg and charge $q_p = 1.29669 \times 10^{-39} m^2$ of the basic photon h, also known as *Planck's constant*.

3. All known physical constants can be derived from these two constants by applying the universal equation (see Table 1). Thus the energy (space-time) of the basic photon h is the hidden real reference system of SI system, from which all other SI units and quantities are obtained in a secondary manner according to the **principle of circular argument**. This is a basic proof that the physical world is a unity.

4. A novel method has been developed, which enables the derivation of many new physical constants within mathematical formalism and their empirical verification by various well known experiments. All natural constants are **dimensionless numbers** - their magnitudes are independent of the choice of the surrogate reference system such as SI system - therefore, the SI system should be eliminated from theoretical physics.

5. *Charge* is a synonym for *geometric area*: 1 *coulomb* = 1 *square meter*.

6. The basic terms - *time, temperature*, and *relativistic mass* - are dimensionless numbers (quotients), the definition of which is mathematics. They are physical sets of the *probability set* ($0 \leq P(A) \leq 1$) as introduced by Kolmogoroff in his theory of probabilities. The probability set is equivalent to the primary term *P(A) = n = space-time = energy*.

7. The *standard model* of cosmology (the hot big bang hypothesis) must be refuted - the universe does <u>not</u> expand. Instead, there is an incessant exchange of energy (and mass) between photons and matter. This exchange is responsible for gravitation, as has been confirmed by the discovery of many new cosmological constants. With the help of these new constants gravitation can be integrated for the first time with electromagnetism and the other two fundamental forces. These constants build a numerical *input-output model* of the universe. This model is equivalent to the continuum.

8. The standard model of physics must be refuted in its reductional attempt to explain nature on the basis of a few elementary particles. At the same time, the new theory confirms all the mathematical results obtained in QED and QCD.

9. Although the various mathematical expressions of the second law of thermodynamics are derivations of the universal equation, the notion of growing entropy in the universe as stated by this law must be rejected.

The extensive mathematical proofs of these results are given in volumes I and II (2-4), which take due account of the basis of modern physics and cosmology. The new integrated physical and mathematical axiomatics follows the principle of inner consistency and lack of contradictions. Therefore, it would be sufficient to reject only one of the aforementioned results to renounce the existence of the Law. However, this is not possible.

2. METHODOLOGY

A methodological analysis of the epistemological foundations of modern physics reveals that the basic terms of this science are not defined. Although all physical laws are laws of energy interactions or can be derived from the concept of energy, physics does not know what energy is in real terms (6). The same holds true for classical space known as Euclidean space (7), relativistic space-time known as Minkowski's world (8), charge, and mass (9), and Hilbert's space of quantum mechanics (10). The only method of describing the physical world is mathematics - all laws and their applications are mathematical equations. This proves that the physical world is of mathematical nature. However, physics does not give us any explanation for this fundamental fact from an epistemological point of view. The agnosticism of physics with regard to its primary terms is propagated in all subsequent concepts of this natural science and biases its edifice.

Like physics, mathematics cannot define its primary terms, such as point, straight line, plane (area) in geometry (10,11), continuum in the theory of sets (12), and number in algebra (13). This has precluded the axiomatization of mathematics by finite procedures (14) as proven by Gödel (15). This proof has led to the **foundation crisis of mathematics** as embodied in the *continuum hypothesis* (16) and *Russell's antinomy* (17). Mathematics is a hermeneutic discipline without a real object of study; it deals with „objects of thought" (Dedekind). Gödel has proved that any axiomatic system of mathematics (18) contains primary statements, which have their source in human consciousness and cannot be determined in a finite way by secondary definitions that are also products of the mind. Each time such formalistic procedures are applied to the structure of mathematics, they lead to fundamental antinomies and challenge its very foundation (15). Therefore, consciousness should be an indispensable part of the theory of mathematics and sub-

sequently of any empirical discipline that implements mathematics (19). However, consciousness is rigorously excluded from physics as an explanatory principle - it is substituted by empiricism.

On the other hand, mathematics, being a hermeneutic discipline without an external object of study, cannot render the missing proof of existence with its own means. Gödel's theorem tells us explicitly that, in order to solve its ongoing crisis, mathematics should seek its proof of existence in the real physical world. The aim should be the development of an integrated physical and mathematical axiomatics based on finite procedures, with the help of which the proof of existence should be experimentally rendered. Such an axiomatics should depart from a small number of axioms - ideally from a single primary axiom - that are valid in both physics and mathematics. In this way, the current artificial separation of the two disciplines will be eliminated for ever.

Departing from this methodological analysis of the present-day structure of physics and mathematics, I have come to the conclusion that it is possible to establish a complete axiomatics of current physical and mathematical knowledge that is based on a single primary term, when the principles of mathematical formalism, as first propagated by Hilbert in 1900 (Hilbert's programme), are consistently applied to physics. This revolutionary approach furnishes the missing „existence proof" in the real physical world and solves the foundations crisis of mathematics that has persisted since 1931 (14), after the publication of Gödel's first theorem (15).

The **primary term** of the new axiomatics is a product of our consciousness: More precisely, it can be equated with our consciousness and can be arbitrarily called „energy", „space-time", „cosmos", „universe", „the whole", „continuum", or „being" („be aware of being"). From an epistemological point of view, the choice of the name is of no importance. This primary (ultimate) knowledge is defined as the „**principle of last equivalence**" (**primary axiom**). It is the furthest boundary of any human knowledge - for ever.

The principle of last equivalence is the common axiomatic origin of both physics and mathematics. According to it, the idea of the continuum in the theory of sets, which is the basis of modern mathematics, is equivalent to the primary term. The same holds true for the probability set in Kolmogoroff's theory of probabilities (20). According to Gödel's theorem (15), the equivalence between the primary term, the continuum of numbers, and the probability set cannot be proven (or rejected) on mathematical grounds. It is an *a priori* axiomatic knowledge. However, it can be verified by <u>all</u> experimental facts in physics and other natural sciences (proof of existence). This is the objective of the new unified theory of physics and cosmology which is based on this principle (2-5, 21).

The new axiomatics takes into account the fact that all physical phenomena (real objects or systems) are adequately expressed by abstract mathematical symbols and relationships, which are objects of thought, and proves that <u>all</u> mathematical equations are concrete applications of the principle of last equivalence for the parts (see below). Thus any mathematical equation is, in fact, a subset of the primary term and contains it as an element. According to Russell, such sets are called "**U-sets**": A U-set is the total set of all sets that contain themselves as an element (17). The same holds true for all the physical quantities that appear in such equations - they are U-subsets of the primary term. As all physical quantities are defined within mathematical formalism, they are abstract concepts (objects of thought). The only real thing is the primary term, that is, energy or space-time, which any physical quantity or magnitude contains as an element in an *a priori* manner.

This novel epistemological approach is based on a single term. It reveals that physics is mathematics applied to the physical world. Therefore, it can be axiomatized according to the deductive, formalistic principle of inner consistency and lack of contradictions. This approach explains at the same time the trend towards mathematisation of all sciences and leads to the development of a **General Theory of Natural Sciences** (2-5, 21-25).

The validity of the new axiomatics is proven in the real world, because the proof of existence is furnished by the principle of last equivalence, which is the primary axiom of both physics and mathematics. This is the crucial difference between the new axiomatics and pure mathematics. While the former operates with real objects, the latter deals with ideal objects of thought. The objective of the new axiomatics is to prove that all abstract mathematical concepts and symbols, such as numbers and signs of relation, adequately express the primary physical term, „energy = space-time". In other words, they are evoked in the mind by its very nature. The reason for this is that human mind is a system (U-set) of space-time which can only reflect the latter - therefore, the primary term of human consciousness is equivalent to space-time.

3. BASIC AXIOMS

3.1 The Primary Axiom

The primary axiom of relation says: „energy is equivalent to space-time: energy = space-time". All the further names and symbols used for the primary term are equivalents. This includes the term „**consciousness**". The primary axiom is called the „**principle of last equivalence**" (**PLE**):

$$Energy = Space\text{-}time = Primary\ Term = Consciousness =$$
$$Universe = Cosmos = Nature = The\ Whole = Continuum =$$
$$Probability\ Set = Mathematical\ Symbols \qquad (1)$$

The primary term is a **U-set** - it is the total set of all sets that contain themselves as an element. All the physical terms and quantities that adequately reflect the phenomenology of space-time are mathematical U-subsets of the primary term, that is, they are objects of thought that contain the whole as an element. Any

physical idea that excludes the primary term as an element is an **N-set:** It has no correlate in the real world and should be excluded from physics as a wrong idea. Such ideas are *vacuum*, *closed system*, etc. For instance, vacuum is considered the set that contains all energetic particles: the void contains something. The N-set is a fundamental paradox or antinomy. The primary term can only be assessed in logical categories. As mathematics is the prolongation of logic with abstract symbols, both are hermeneutic disciplines of correct thinking. Currently, it is believed that they have no external object of study. According to PLE, their external object of study is space-time. This conclusion renders the missing proof of existence of mathematics. It also explains the mathematical character of the physical world, namely, why all natural laws are mathematical equations.

3.2 Properties of Space-Time (Energy)

The properties of space-time (energy) are: **closed character**, **infiniteness**, **continuousness**, **inhomogeneity** (**discreteness**), and **constancy**. They are interrelated U-sets and thus equivalent to the primary term. U-sets cannot be separated in real terms, but only in an abstract way in the mind. These properties are manifested by all U-subsets of space-time. The *conservation of energy* (1st law of thermodynamics) confirms the closed character of space-time. The *quantization* of energy in photons ($E = h\,f$) and particles (Bohr's model, Schrödinger wave equation) confirms the inhomogeneity of space-time and the constancy of the quanta, for instance h, or the existence of natural constants. The equivalence between energy and space-time proves the continuousness of the physical world and excludes the idea of the void (vacuum) as an N-set - the extent is space-time, that is, energy.

Space-time can be subdivided into infinite levels and systems. The U-set of equivalent constant amounts of energy, called „**systems",** is defined as a „**level".** For instance, all protons have

the same energy (at rest) and form the proton level. As we do not know how many protons there are in the universe, we define the proton level as infinite. The discreteness of space-time is infinite in real and abstract terms. It is not possible to distinguish between the abstract infinity of numbers as objects of thought (mathematics) and the real infinity of levels and systems of space-time. Hence the equivalence between consciousness and the primary term - **consciousness is reflected space-time (energy)**. All levels and systems are open - they exchange energy (space-time). We say: "They interact". The openness of the U-subsets of space-time is an aspect of its infinity. However, space-time itself is closed.

3.3   Symbolic Expression of the Primary Term

"**Energy exchange**" and "**energy interaction**" are synonyms for the primary term. Space-time is in a permanent state of energy exchange:

$$primary\ term = energy\ exchange = space\text{-}time\ exchange = E \quad (2)$$

According to the PLE the arbitrary symbol of the primary term "E" is an object of thought. Therefore, it can be substituted by any other mathematical symbol, such as:

$$E = \infty = 1 = E\,/\,E = 1/1 = 1/\infty = \infty/1 = \infty/\infty = n = \text{etc.} \quad (3)$$

It is important to observe that this equivalence cannot be rejected on mathematical grounds because it concerns the proof of existence. According to Gödel's theorem, this proof cannot be given by means of mathematics. The equivalence of the symbols in equation (3) is therefore <u>beyond</u> the reach of mathematical argumentation. At the same time, it is the epistemological (philosophical) origin of both mathematics and physics.

For instance, we can substitute the primary term in equation (3) with any quotient of infinite mathematical complexity, which can be a product of differential, integral, or exponential calculus $1 = \infty/\infty$, where the symbol for infinity „∞" stands for mathematical complexity. All the equations in mathematics and physics, e.g. as natural laws, no matter how complex they may be, are formulated as **numerical relationships** (**quotients**) to the primary number „one" $= 1$. As we shall show below, this elementary formalistic conclusion can be easily proven by any person with a modest knowledge of mathematics and physics. This basic theoretical evidence is currently not fully apprehended by all physicists and theoreticians, notwithstanding the fact that it renders the epistemological ground, why Nature is of mathematical character, e.g. why it can be adequately assessed by natural laws that can be expressed in terms of mathematical equations.

3.4   Basic U-Subsets of Energy Exchange

The energy exchange between the levels is arbitrarily called „**vertical energy exchange**", while that between the systems „**horizontal energy exchange**". E is <u>at once</u> vertical and horizontal (U-sets). The elementary event of energy exchange is called „**action potential**" and is symbolized with E_A. As all systems and levels are U-subsets, the definition of the elementary event is an arbitrary decision of the mind. We call this mental aspect the „**degree of mathematical freedom**". Thus any system or level can be defined as E_A. Any arbitrarily defined E_A has a correlate in the real world (U-set). All the physical events or phenomena that are objects of study in physics can be defined as „action potentials" and expressed as E_A. Thus the term "action potential" is the total U-set of all discrete events of energy exchange. For instance, the basic system of a level, say an electron, is called an „elementary action potential" and can be expressed with E_A. The level is the total set of all action potentials pertaining to it, e.g. an electron level. The systems of

this level are sets consisting of E_A, e.g. electron orbits; at the same time they are subsets of the electron level. E_A is a specific mean constant amount of energy for each level or system, defined in an abstract way within mathematics that is always confirmed in an empirical way.

The quotient of energy exchange and action potential is defined as "**absolute time**" or simply "**time**": $f = E/E_A$. The quantity *time* is an abstract U-subset (object of thought) of space-time, which is an integral part of mathematical formalism. It is a **dimensionless number**, a quotient belonging to the continuum. This term is not identical with the quantity „*conventional time t*" as used in physics today. The definition of the latter quantity requires the definition of the SI unit „second" and its *method of measurement* (see below). Thus the quantity „conventional time" is a secondary U-subset of the primary category „time", which is directly derived from the primary term in an axiomatic, *a priori* manner. Conventional time is a concrete quantity of time. Within the new axiomatics, it can be shown that many physical quantities, which are erroneously regarded to be distinct, real quantities of matter, appear to be particular mathematical parameters of time. The most outstanding are: *temperature* and *magnetic field*.

3.5 The Universal Law is a Mathematical Equation

The primary term can be expressed as a mathematical equation:

$$E = E_A f \tag{4}$$

We called it the „**universal equation**" (**UE**). This mathematical expression considers all the properties of space-time. The proof is cogent (see below). All conventional laws are mathematical equations and thus U-subsets of space-time - they contain equation (4) as an element. We shall prove that they are mathematical derivations of UE, that is, they are objects of thought and have no real existence

outside mathematics. Thus, there is only one law, called the „**Universal Law**", which is expressed by the above equation. It assesses the primary term mathematically and is equivalent to it. According to PLE, equation (4) can be expressed by any other symbol, such as:

$$E = E_A f = 1 = \infty = n = 1/n^n = n^n/1 = n \times 1/n =$$

$$= \sum \infty \times \sum 1/\infty = \infty/1 \times 1/\infty = etc. \qquad (5),$$

where the primary number „1" is the universal mathematical symbol of equivalence with respect to the primary term; this number can also be used for any subset thereof, e.g. as the „*certain event*" in statistics or as a SI unit, e.g. 1*m*, 1*s*, 1*C*, 1*joule*. According to PLE, the primary number can be substituted by any other number without changing anything in mathematics and physics.

All mathematical equations are built as quotients that are equivalent to 1: $\infty/\infty = 1$, where „∞" symbolizes the „infinite mathematical complexity" introduced by scientists through infinitesimal calculus, statistics, geometry, topology or any other sophisticated mathematical procedure. Therefore, all equations in science are mathematical U-subsets of PLE and the primary term: the infinite complexity of mathematics merely reflects the infinity of space-time. While searching for particular solutions in the growing complexity of mathematical models, physicists have overlooked this simple fact of great cognitive importance. This attitude has obscured the existence of one Universal Law of Nature.

In equation (5) *n* is *continuum*, ∞ is *infinity*, $1/\infty$ is the *infinitely small number*, and $\infty/1 = \infty$ is the *infinitely great number*. The last two terms define the continuum: $1/n \rightarrow 0$, when $n \rightarrow \infty$. In the theory of sets, „zero" and „infinity" are defined as the limits of the continuum. They are abstract subsets (objects of thought) of the primary term. It is important to observe that all these abstract symbols can be substituted by any other symbol or word, which is of

the same mathematical character. They will inevitably assess the properties of space-time, for example, its infinity due to the closed character. As space-time is of mathematical nature, all the words and symbols used for the continuum reflect its closed nature. For instance, instead of saying in mathematics „the continuum is infinite“, we can say „the infinity is continuous“. This follows from the principle of last equivalence, which is the common origin of mathematics and physics. The existence of such basic tautologies determines the limit of any human knowledge for ever and proves the closed character of space-time.

The fundamental formalistic finding that all mathematical equations, for instance, all physical laws and their applications, represent quotients that, according to PLE, are set equivalent to the primary number "1" and are thus U-sets of the primary term, will be illustrated by the following two examples. These examples constitute the basic „**proof of existence**“ of mathematics in the real physical world. At the same time, they prove the existence of only one Law of Nature that can be mathematically expressed as a **rule of three** or a mathematical derivation thereof of endless complexity.

3.6 Proof of Existence of Mathematics and the Universal Law within the New Integrated Physical and Mathematical Axiomatics

Let us take any equation of infinite complexity (∞) used in quantum mechanics or any other physical discipline and prove that it can be expressed as a quotient that is equivalent to the primary number "1": $\infty/\infty = 1$. Alternatively, the critical reader may try to find a mathematical equation that cannot be presented in this way. This is a basic formalistic proof for the existence of the Law that is also confirmed by all physical results. In addition, one can prove that the number "1" can be substituted by any other number of the continuum n, that is, $n = \infty/\infty = \infty = 1$. The proof of existence confirms

16

that any scientific knowledge of nature exists *a priori* in the mind, so that any categorical system of science can be axiomatically derived from the primary term and expressed in terms of mathematics (mathematisation or axiomatization of science).

This is the ultimate epistemological and cognitive basis of the new integrated physical and mathematical axiomatics of the Universal Law: For this purpose, we have randomly selected two different physical equations from the literature:

Example a): The *equation of conservation of quantum probability*, which is an approximate solution of Schrödinger's equation in the perturbation theory of David Bohm in „Quantum Theory", Dover Publ., New York, 1979, p. 416:

$$\left|A_s\right|^2 = 1 - 2l^2 \sum_{n \neq s} \left\{ 1 - cos\left[\frac{\left(E_s^{\,o} - E_n^{\,o}\right)}{\hbar}\left(t - t_o\right)\right]\right\} \frac{\left|V_{sn}\right|^2}{\left(E_s^{\,o} - E_n^{\,o}\right)^2}$$

Solution: We assign the right term of this equation the symbol B and express the above equation as a quotient:

$$1 - 2l^2 \sum_{n \neq s} \left\{ 1 - cos\left[\frac{\left(E_s^{\,o} - E_n^{\,o}\right)}{\hbar}\left(t - t_o\right)\right]\right\} \frac{\left|V_{sn}\right|^2}{\left(E_s^{\,o} - E_n^{\,o}\right)^2} = B$$

$$\frac{\left|A_s\right|^2}{B} = 1$$

We can now multiply this equation with an arbitrary number belonging to the continuum, for instance with $n = 1000$:

$$\frac{\left|A_s\right|^2}{B} = 1\Big|\times 1000$$

$$\frac{1000 \times \left|A_s\right|^2}{B} = 1000$$

When we set $1000\times|A_s|^2 = A$, we obtain A/B = 1000. If we express $A = E$, $B = E_A$, and $f = 1000$, we obtain the universal equation $E = E_A\, f$.

Example b): The *uniqueness theorem* for rotating black holes in Markus Heusler „Black Hole Uniqueness Theorems", Cambridge University Press, Cambridge, 1996, p. 227, eq. (12.77):

$$I_R = \mu \oint_{\partial S_R} e^{-h(\phi)}\left[\left(1 - y^2\right)h^{(\phi)},_y\, dx - \left(x^2 - 1\right)h,_x dy\right]$$

Solution b): We assign the right term of this equation the symbol *B* and express it as a quotient:

$$\frac{I_R}{B} = 1$$

When we multiply this equation with *n* we obtain $I_R n/B = n$. If we set $I_R n = A$, we obtain again the universal equation as a rule of three: $A/B = n$ or $E/E_A = f = n = 1$. From this presentation it follows that:

$$\frac{\infty}{\infty} = \infty = 1 = n = primary\ term = space\text{-}time =$$

$$= infinite\ mathematical\ complexity$$

We conclude: All the mathematical equations in physics and science are obtained from the primary term according to PLE; they are U-subsets of the universal equation, which assesses the properties of space-time in terms of mathematics by assigning it (or a U-subset thereof) the number „one" = 1. This is the *apriori* universal formalistic procedure, which allows the application of mathematics to real objects.

These examples prove in an irrevocable manner that the *continuum* is an equivalent and adequate term of space-time. As *Kolmogoroff's probability set* $0 \leq P(A) \leq 1$ is obtained from the continuum by mathematical transformation according to PLE: $1/n \rightarrow 0 = P(A) \geq 0$, and $n \rightarrow \infty = P(A) \leq 1$ (according to PLE, $1 = \infty$), this basic term of statistics is another equivalent, abstract presentation of space-time. We call this set the „**physical probability set**" and express it with the symbol *SP(A)*, where „S" stands for „structure", so that we can distinguish it from Kolmogoroff's abstract term. This new symbol allows the epistemological discrimination between the theory of probabilities as a hermeneutic discipline and statistics as mathematics applied to the real physical world, e.g. in thermodynamics, QED, QCD, etc. From this, we can write PLE as follows:

$$Energy = Space\text{-}time = n = \ 0 \leq SP(A) \leq 1 = SP(A) = 1 \qquad (6)$$

The equations from (1) to (6) are iterations of the primary term according to PLE - they are mathematical tautologies or pleonasms thereof. This is a basic proof for the closed character of space-time. <u>Any mathematical equation is an iteration of the last equivalence for the parts</u> (U-subsets of space-time). For instance, the universal equation (4) can be expressed as a *rule of three $a = b/c$* or a *function $y = ax$*. The latter is the origin of any other function in mathematics, such as:

$$y/(a^n x^n ... + ... a^{n-m} x^{n-m}) = 1, \ \ \text{where } m = 1,2,3... \, n \qquad (7)$$

or

$$(a^n x^n ... + ... a^{n-m} x^{n-m}) \, / \, \mathrm{y} = E_x \, / \, E_r = E_x \, / \, 1 = E_A f \qquad (8),$$

where

$$E_x = a^n x^n ... + ... a^{n-m} x^{n-m} = ax = E_A \, f = E_A = cons.,$$

$$\text{when } f = 1 \qquad (9).$$

These presentations prove that mathematics is a system of mathematical iterations of the universal equation, while the latter is the „mathematical envelope", with which the nature of space-time is formally wrapped. With respect to tradition in physics, we call this equation the „**Universal Law**", or just the „**Law**". This is justified, as all known physical laws and other equations can be derived from this Law (2-5, 21).

3.7 Quantities of Space-time and Their Method of Definition and Measurement

All the physical quantities with which nature is described are abstract U-subsets of space-time. Mathematics is the only method of definition and measurement of such quantities, that is, they have no real meaning outside mathematics (objects of thought). Physical quantities are built according to the „**principle of circular argument**" (**PCA**). This is the only operational principle of mathematics and physics. In fact, it is the only cognitive principle of our mathematical consciousness. PCA consists of two dialectical aspects: 1) the building of equivalencies, e.g. as SI units - all meter rules are the same the world over; 2) the building of comparisons, e.g. measurements with SI units in the real world. **The PCA is an application of PLE for the parts** - it departs from the whole to explain the parts. This principle is thus a U-subset of PLE. The building of any mathematical equation with a view to assessing U-subsets of the primary term is based on PCA. This means that all known physical laws, expressing relationships between various

physical quantities, abide by PCA and PLE. They contain the primary term, space-time as an element (see Table 2).

The principle of definition of physical quantities used in physics today is „*circulus viciosus*“, that is, any quantity is defined through other quantities, e.g. mass through acceleration, charge through current, etc. One part is explained by other parts, while the primary term is neglected. Physics does not know the nature of space-time. This has led to a profound agnosticism with regard to the meaning of these quantities.

3.8 Dimensions, Quantities, and Units of Space-Time

Physics consists of two parts: theoretical and empirical. The theoretical part consists of definitions of physical quantities; the empirical part consists of their measurement (experiments) by building relationships (comparisons) in the real physical world. The method of definition of quantities is at the same time the method of their measurement - both methods are applications of PCA. There is no exception to this equivalence between mathematical theory (formalism) and empiricism. Within mathematics, the primary event is the *a priori* definition of quantities as mathematical objects of thought. Empiricism is of secondary importance - it is an experimental confirmation of the Law for each particular energy interaction. This ubiquitous fact proves that mathematical consciousness is an adequate reflection of the physical world. This is the epistemological background of the new axiomatics. Modern physics, on the contrary, has failed to give an explanation of its terminology from an epistemological point of view and has, instead, resorted to pure empiricism as the only source of knowledge. Hence its profound agnosticism.

Any quantity is expressed in units. Each unit stands for a dimension, and each dimension corresponds to a quantity. However, there are quantities that have more than one dimension, e.g. *force* is expressed by the dimensions *mass*, *length*, and *conventional*

time with the units [$kgms^{-2}$]. The definition of a quantity cannot be distinguished from the definition of its unit(s) and dimension(s). Each definition of a quantity and its corresponding SI unit is based on a **real reference system** of space-time by assigning it the number „one" according to PLE and PCA. For instance, both *metre* for space and *second* for conventional time are defined with respect to the photon level: 1 meter is equivalent to the distance travelled by light (visible photons) during 1/299,792.458 second; 1 second is defined by the frequency of photons $f = c/wavelength$ emitted by a caesium atom. As $c = f\lambda$, both definitions are circular - they resort to the number „one", e.g. when $f = 1/t = 1s^{-1}$, $c = \lambda$ and vice versa, when $\lambda = 1$, $c = f$ within mathematical formalism. If we compare the wavelengths λ and frequencies $f = 1/t$ of two photons by defining one of the photons as a reference system, we obtain dimensionless quotients for the two dimensions, space (distance) $\lambda_x/\lambda_r = SP(A) = n$ and time $f = 1/t = f_x/f_r = SP(A) = n$. The same holds true for any other real distance and time. The terms „meter" and „second" are thus non-mathematical surrogates that substitute the reference frequency f and wavelength λ of a <u>real</u> photon, which has been arbitrarily selected as the **initial reference system** of SI. It can be substituted by any other real system of space-time. The SI units, „1 *second*" for the dimension (quantity) „conventional time t" and „1 *meter*" for the dimension (quantity) „distance" are thus sur-rogates of real space-time quantities that are initially obtained as dimensionless relationships between two real systems, one of them being usually defined as a reference system or unit, and should be, therefore, eliminated within mathematical formalism. The current usage of SI units only obscures the physical understanding of Nature.

It is generally acknowledged that there are six basic quantities and units - *space* (*m*), *conventional time $t = 1/f$* (*s*), *mass* (*kg*), *temperature* (*K*), *amount of substance* called *mole* (*mol*), and *current* (*A*). As *charge (C)* is actually introduced through the current in a circular manner, this quantity is not basic. All the other quan-

tities can be derived from these six quantities and their units within mathematics. It can be proven that the last four basic quantities and their units can be derived from the first two dimensions, space and time, within mathematics. This means that **space-time has only two dimensions** or **constituents**, **space** and **time** *f*: hence „**space-time**" for the primary term. Therefore, all quantities can be expressed in terms of space and time (see Table 2). As all physical laws assess relationships between various quantities, this is also true for these laws. This allows the establishment of a new simple mathematical symbolism that can be axiomatically introduced from the primary term (see chapter 3.13).

3.9   Motion is the only Manifestation of Space-Time

Human consciousness assesses energy exchange as **motion** (displacement). Motion is the only manifestation of energy exchange or space-time within the limitations of human senses. The universal physical quantity of motion in physics is *velocity* v. From v one can obtain further quantities of motion within mathematics, for instance *acceleration a*. As velocity is an abstract mathematical quantity too, it can be substituted by any of these quantities without affecting the validity of the present axiomatics. We have chosen velocity as the universal quantity of motion for practical and historical reasons. Velocity is defined within mathematics as a quotient of the two identical quantities, space and conventional time, according to PCA $v = s/t = sf$. Within 3*d*-Euclidean space, distance is given as [1*d-space*], area as [2*d-space*], and volume as [3*d-space*]. The method of definition of these abstract quantities is *geometry*. We shall use these symbols in the new axiomatics for any spatial presentation [*n-d-space*], where *n* means any number of dimensions and is equivalent to the continuum. This symbol includes any geometric presentation, such as multidimensional spaces in topology (e.g. in string theories) or fractal spaces in chaos theory.

The new dimensionless quantity *time f = E/E$_A$* is defined in an *a priori* mathematical manner as a quotient of the primary term and its universal event - the „action potential". The latter term is also defined in an *a priori* manner as the total set of all events or phenomena in the real world. The two terms, time *f* and action potential E_A, are the two most important subsets that establish the unity of space-time, because they completely assess its properties in a mathematical way. For this reason, we use only these three symbols in the universal equation $E = E_A f$. Within mathematics, the number of symbols, standing for different quantities of space-time, can be augmented *ad infinitum*. We call this "**the degree of mathematical freedom**" - like space-time, the number of physical quantities, which human consciousness can define, is theoretically infinite: space-time=(mathematical) consciousness = infinity (PLE). Hence the intrinsic complexity of physics, which is applied mathematics. This mathematical complexity has hindered the perception of one single Law of nature. This is the greatest fallacy of modern physical theory.

When the surrogate SI system is employed, the abstract quantity time can be assessed by the actual parameters, frequency *f* or reciprocal conventional time $1/t$, within mathematics according to PCA: $f = E/E_A = 1/t = f$. Both quantities are U-subsets of time. In this way, we conclusively eliminate the term „conventional time" from physical theory and substitute it with the term „time" *f*. This is also the reason why we use the symbol „*f* ", which is traditionally employed for frequency, although we could just as well introduce any other symbol for time. It is important to observe that frequency or its reciprocal „conventional time" are not the only actual quantities of time. For instance, we can establish within the new axiomatics that *temperature* and *magnetic field* are further specific quantities of time. This finding eliminates the exclusive character of conventional time. For practical purposes, we can still use *t* in terms of seconds or any other unit of time by employing

24

conversion factors. Within mathematical formalism, **velocity** can be expressed as:

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

$$= [1d\text{-}space\text{-}time] \qquad (10)$$

The product of one-dimensional space [1*d-space*] and time *f* results in an abstract mathematical quantity, called „**one-dimensional space-time**". It is a U-subset of the primary term. The method of definition is geometry (space) and algebra (time), that is, mathematics. Space and time are "**constituents**" of space-time. This is an axiomatic definition derived from the primary term. According to PLE, we can express the primary term as follows:

$$E = E_A\, f = v = [1d\text{-}space\text{-}time] = v^n = [\text{n-}d\text{-}space\text{-}time] =$$
$$= constant = 1 \qquad (11)$$

3.10 Reciprocity of Space and Time

Equation (11) proves that the space-time of any system or level is constant because it is a U-subset of the primary term and manifests the **constancy** of space-time as an element. For example, the speed of light *c* is a constant one-dimensional space-time of the photon level $c = [1d\text{-}space\text{-}time]$. This axiomatic conclusion is confirmed by all facts - it is an irrevocable proof that the new axiomatics adequately assesses the physical world (empirical validation):

$$v = [1d\text{-}space\text{-}time] = [1d\text{-}space]\, f = \infty \times 1/\infty = constant = 1 \quad (12)$$

We conclude from equation (12) that *space* and *time* are **canonically conjugated, reciprocal quantities** that cannot be separated in real terms (U-sets), but only in an abstract way in mathematics, that is, in the mind. The infinitely great number ∞ and the infinitely

small number 1/∞, being defined as the limits of the continuum, are thus mathematical symbols which intuitively reflect the reciprocity of real space and time. As space and time cannot be separated in real terms, they form the unity of space-time. Thus space-time contains at once the infinite small and the infinite great. The reciprocity of space and time is without exception - as a fundamental property of space-time, it is manifested by each subset thereof. This is a basic axiomatic conclusion of the new theory that is central to an understanding of the Law. We can write:

When   [n-*d-space*] $\rightarrow \infty$, then $f \rightarrow 1/\infty$ and vice versa   (13)

Or $E = E_A f \approx f = 1/\,[space]\ = 1/t$ (14)

   Axiom of reciprocity: Space-time (energy) is proportional to time f and inversely proportional to space, respectively, to conventional time t. Time f is inversely proportional to space and conventional time t and vice versa.

This basic axiomatic conclusion is confirmed by all physical phenomena: the greatest energy is found in the smallest space of the atoms (e.g. strong forces of hadrons and quarks, black holes, etc.) and the smallest energy is found in the greatest volume, e.g. in gravitational objects: red giants vs. black holes. There is no exception to this rule. This is a fundamental proof that physics can be axiomatized from a single term.

   At the same time, this axiom reveals the fundamental gnostic fact that space and conventional time are <u>identical</u> physical quantities built within mathematics that are erroneously considered to be distinct entities. For this reason, velocity is a tautological quantity which does not contribute to our understanding of space-time, but only forges the **hallucinatory perception** of space-time by human mind as *extent* (space), where certain objects move with different velocities. Therefore, motion (displacement) is the universal hallu-

cinatory perception of energy exchange by human consciousness within the energetic limitations of his senses (see vol. III).

3.11 Mathematical Presentation of the Reciprocity of Space and Time

Space-time is the only real entity. Because of this, the only thing we can do in physics is to assess the actual space-time of the systems or levels. According to PCA, the space-time E_1 of any system can only be assessed in a circular comparison to the space-time of a reference system E_2. This is a consequence of the closed character of space-time and explains why PCA is the only operational principle of physics and mathematics. Due to the reciprocity of space and time, the universal equation can be presented as a **rule of three** (**RT**):

$$E_1/E_2 = f_1/f_2 = [1d\text{-}space]_2/[1d\text{-}space]_1 = SP(A) = n = K_{1,2} \quad (15)$$

Equation (15) proves that all we can do in physics is to compare the space, time, or space-time of one system with that of another. The quantities which are defined in this way are **dimensionless quotients**, whereas any comparison with a unit reference system $n/1 = n$ is a number belonging to the continuum. This comparison is a real energy interaction. Therefore, any measurement in an experiment is an energy interaction. The dimensionless coefficient $K_{1,2}$ assesses the energy exchange between any pair of systems or levels. It is called the „**absolute constant**" of energy exchange. As all systems are open U-sets, energy exchange always occurs in both directions: in this case, $K_{1,2} = 1/K_{2,1}$. Such constants belong to the continuum or the probability set, that is, to the primary term. By eliminating the surrogate SI system, we prove that all known natural constants are **absolute constants**. They are constant dimensionless relationships of space, time or space-time quantities of real systems,

which are obtained within mathematics by employing the universal equation (see Table 1).

3.12 Photon Space-Time is the Universal Reference Frame

According to PCA, the universal real reference frame of the new axiomatics is the space-time of the photon level as assessed by the constant speed of light:

$$c=[1d\text{-}space\text{-}time]_P = c^n = [n\text{-}d\text{-}space\text{-}time]_P = constant = 1 \quad (16)$$

The same reference frame is used in classical mechanics as G, in electromagnetism as $c^2 = 1/\mu_o\varepsilon_o$, and in the theory of relativity as Lorentz transformations. Theoretically, it can be substituted by any other reference frame (degree of mathematical freedom). We have selected photon space-time as the universal reference frame with respect to traditional physics. This allows a simple transformation of conventional formulae into the new **space-time symbolism**.

3.13 The New Space-Time Symbolism

In the above disquisition, we have already introduced the new symbols of the new integrated physical and mathematical axiomatics, with which all traditional physical quantities and laws can be presented in terms of space-time (see Table 2):

E - Space-time = energy = primary term

E_A- Action potential = elementary event of energy exchange: $E = E_A = cons.$, when $f = 1$

f - (absolute) time, $f = E/E_A$

$[n\text{-}d\text{-}space]$ - Space in terms of geometry = extent

28

SP(A) -   Any physical quantity of space-time as a pro-
                bability (dimensionless quotient) belonging
                to $0 \leq SP(A) \leq 1$, where $0 \leq SP(A) \leq 1 = n$. In parti-
                cular, this symbol is reserved for mass *m* and
                charge *Q* (see below)

$E = E_A f =$
$[n\text{-}d\text{-}space] f =$
SP(A)$[n\text{-}d\text{-}space\text{-}time]$
$= n = 1$ -   Universal equation of the primary term according
                to PLE and PCA. *SP(A)* stands for the space-time
                of any system or level (U-subset) that can be ob-
                tained as a relationship (probability or number)
                to a reference system of space-time.

Any science is a categorical system of the mind. When the catego-
ries are U-sets, that is, when they are derived from the primary term
by PCA, the system can be axiomatized. All axiomatic systems are
thus „*transitive*": They are equivalent presentations of space-time.
This is called the „**commutative law**" of the new axiomatics - it is
an iteration of PLE. For instance, geometry can be presented as
algebra and vice versa. The new axiomatics is transitive to mathe-
matics: any traditional mathematical expression of space-time in
terms of a physical law, a quantity, or a relationship thereof can be
expressed in the new space-time symbolism without affecting the
final numerical result. Due to the significant simplification of the
new symbolism and its clear epistemological background, many new
natural constants, which have hitherto evaded the attention of physi-
cists, have been derived for the first time. These constants can be ex-
perimentally verified. This is a convincing experimental proof that
physical empiricism is a tautology of the Universal Law for each
particular experimental condition.
    The new axiomatics acknowledges the creative potential of ma-
thematical thinking. It is not a particular categorical system, but
the universal method of creating infinite categorical systems that

abide by the formalistic principle of inner consistency and lack of contradictions. This leads to the unification of science under:

one principle = one term.

3.14 Mass is an Abstract Mathematical Quantity of the Mind

The quantity *mass* does <u>not</u> exist. It is an object of thought that is defined within mathematics. In mechanics, mass is defined as „the intrinsic property of an object that measures its resistance to acceleration" (9). This is a tautological definition of Newton's 2nd law $F = ma$, where acceleration $a = v/t = vf = [1d\text{-}space\text{-}time]f$ is already an abstract U-subset of space-time as defined within mathematics. One abstract subset of space-time is defined in terms of another. All traditional definitions of physical quantities display this vicious character. For this reason, physics cannot explain its terms such as mass and charge in terms of knowledge (epistemological agnosticism). This vicious circle is substituted in the new axiomatics by PCA as a U-subset of PLE - we depart from the primary term (the whole) to explain the parts, which are mathematical quantities of space-time. Their relationships are presented conventionally as mathematical equations and defined as „physical laws". As all mathematical equations are U-subsets of PLE, all known physical laws are U-subsets of the Universal Law, and this law assesses mathematically the properties of the primary term.

The method of definition of *mass* is mathematics. It is also the method of its measurement. The real reference system is a standard object preserved at the International Bureau of Weights in Sèvres, France. Its *gravitational energy E_x* on the earth is called „1 kg". The measurement of masses, that is, weights, is based on Newton's 2nd law (definition) and can be axiomatically derived from the primary term within mathematics:

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

(17)

From equation (17), we conclude that „mass" is a mathematical „**space-time (energy) relationship**" that is established by PCA. The same is true for „charge" - it is an „**area relationship**" defined within geometry (see chapter 3.19). This is the topic of a separate publication. In the following, we shall present some fundamental formalistic proofs for the *theory of relativity*, which will show in an impeccable manner that this basic physical discipline is no more than applied statistics to the primary term - space-time.

3.15 Lorentz Transformations in the Theory of Relativity are Mathematical Iterations of Kolmogoroff's Probability Set

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; the latter is a basic cognitive blunder of present-day physics, as we shall show below. 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 PCA by selecting photon space-time as the initial reference frame. When *FitzGerald length contraction* and *Lorentz time dilution* are expressed within the theory of relativity, it be-

comes cogent that the **Lorentz factor** is another mathematical presentation (iteration) of **Kolmogoroff's probability set**:

$$\frac{t_R}{t} = \frac{L}{L_R} = \gamma^{-1} = \sqrt{1 - \frac{v^2}{c^2}} = 0 \le SP(A) \le 1 \qquad (18)$$

when v → 0, then $\gamma^{-1} \to 1$,
when v → c, then $\gamma^{-1} \to 0$

In equation (18), t_R is the *rest time* between two events (<u>Note</u>: all events are action potentials), also called "local" or "own time" that is measured in a system at rest; t ist 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 γ^{-1} assesses the relativistic change of space and time, that is, of the space-time of the systems in motion. In the new axiomatics, motion is the universal manifestation of energy exchange, that is, of the primary term. This axiomatic knowledge is the departing point of the theory of relativity too, which postulates that all objects are in relative motion (*principle of relativity*). From equation (18), it becomes evident that:

the **Lorentz factor** gives the **physical probability space**:

$$\gamma^{-1} = 0 \le SP(A) \le 1$$

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 photon space-time: $E_p = c^2 = [2d\text{-}space\text{-}time]$. When we substitute conventional time t with time $f = 1/t$ in equation (18), we obtain the universal equation as a rule of three (see also equation (17)):

32

$$\frac{E_1}{E_2} = \frac{f_1}{f_2} = \frac{[1d-Raum]_{.2}}{[1d-Raum]_{.1}} = \frac{t_R}{t} = \frac{L}{L_R} = \gamma^{-1} = \sqrt{1-\frac{v^2}{c^2}} = K_{1,2} =$$

$$= SP(A) \qquad\qquad (19)$$

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, the theory of relativity is fully 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 the light of the new axiomatics, as their erroneous conventional interpretation is the main source of the cognitive malaise which afflicts physics today.

3.16 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, it becomes cogent that Einstein's equation postulating the equivalence between energy and mass $E = mc^2$ is a tautological statement. This equivalence plays a central role in the theory of relativity and 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 $m = E/c^2 = E_x/E_p$. According to PCA, the energy of any object of matter E_x is compared to the energy of a reference sys-

tem, in this case, to the level of photon space-time, and is given as an energy relationship $m = SP(A)$. 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:

$$E = E_{kin} + m_o c^2 = \frac{m_o c^2}{\sqrt{1 - \dfrac{v^2}{c^2}}} = \gamma m_o c^2 = m_r c^2 \qquad (20)$$

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 *relativistic mass* and *rest mass: $m_r = \gamma m_o$*. Equation (20) 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:

$$m_o/m_r = \gamma^{-1} = 0 \leq SP(A) \leq 1 \qquad (21)$$

We encounter PCA 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**:

$$m_o/m_o = m_o = SP(A) = 1 \qquad (22)$$

34

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. 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 the rest mass according to PCA. As mass is a space-time relationship, any relativistic mass of a system is <u>greater</u> than its rest mass: $m_r > m_o$. Their quotient represents the **physical probability set:** $m_o / m_r = 0 \le SP(A) \le 1$.

The above relativistic equations are derived by PCA and include the entire cognitive background of 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.

3.17 Basic Axioms of Application

Space-time is energy exchange. As it consists of infinite, open U-subsets (levels, systems), it cannot be assessed in a finite, deterministic way. However, any infinite quantity of U-sets forms a set that contains the subsets as an element - the common element being space-time. According to PCA, which is the only operational principle of mathematics and physics, any assessment of space-time needs a reference system. Therefore, any actual space-time exchange can be assessed as an interaction between at least two entities (systems, levels, or action potentials). This knowledge leads to the following fundamental axiom:

The action potential of a level or system E_{A1} is completely exchanged (transformed) into the action potential E_{A2} of another level or

system and vice versa. This is called the „**axiom of conservation of action potentials**" (**axiom of CAP** or simply **CAP**):

$$E_{A1} = E_{A2} \tag{23}$$

All conventional statements on the *conservation of energy* (closed character of the primary term) in physics, such as the conservation of momentum, mass, charge, number of baryons, etc., are incorporated in CAP and can be eliminated as distinct laws. This axiom leads to another basic axiom, called the „**axiom of reducibility**" (**AR**):

> Any energy exchange in space-time can be regarded as an interaction between two entities (systems, levels, or action potentials), which are U-sets and may contain infinite levels and systems. Any energy interaction results in a new entity, the space-time of which is the product of the space-time of the two interacting entities according to CAP (law of conservation of energy):

$$E = E_1 \times E_2 = E_1 E_2 \tag{24}$$

Both axioms describe the nature of the primary term - they are mathematical variations on the reciprocity of space and time. These two axioms are of great practical importance. As most physical laws are defined for closed systems, they can be defined by CAP. Thus the idea of closed systems, being an N-set, can be eliminated - all systems are open. The AR is the „hidden definition" (Poincaré) behind most physical laws, which appear to be intuitively correct perceptions of the Law within human mathematical consciousness. The two axioms, CAP and AR, are applications of PLE for the parts. This insight effects a great simplification in our understanding of present-day physics, as it explain for the first time from a cogent philosophical point of view the *a priori* epistemological origin of all

36

natural laws from human (mathematical) consciousness. Precisely, it proves the priority of consciousness - the „platonic world of human ideas" - over empiricism. This is the greatest mental revolution which the new integrated physical and mathematical axiomatics brings about in the theory of science.

3.18 Applications of AR and CAP in Physics

AR can be applied to the space-time of any system or a quantity thereof. Consider an object at rest with the mass $m = SP(A)$. When this object moves in space-time, e.g. in a free fall, it acquires additional space-time that can be assessed by the one-dimensional quantity of space-time, the velocity: v = [1*d-space-time*]. According to AR, 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 $E_r = m$ and the space-time of its displacement E_k, which is assessed by the velocity, as another distinct entity E_k= v. In this case, the velocity is a quantity of the gravitation of the earth, which we regard as the second interacting system. The quantities and symbols used for the space-time of the interacting systems are arbitrarily selected and can be replaced by any other quantity or symbol without affecting the validity of AR, which is a primary axiom of the mind (see Gödel's theorem). 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, which is the system resulting from this interaction. In this case, we obtain the *momentum* of the object, which is a fundamental quantity in classical mechanics:

$$E = E_r E_k = m\text{v} = SP(A)[1d\text{-}space\text{-}time] = momentum = p \quad (25)$$

In physics, momentum is expressed as a vector, which is a [1*d-space*]-quantity. Its method of definition is the geometry of Euclidean space. AR holds not only for quantities, but also for the definition of all traditional laws in physics, which are applications of

the universal equation. For instance, the paradigm „elastic colli-sion" is a hidden application of AR and CAP; it is a frequent para-digm for the formulation of different laws and their applications.

A typical example is the *law of conservation of momentum*, which is a subset of CAP. When the space-time of two moving systems, E_1 and E_2, is described as momentum, m_1v_1 and m_2v_2, their product gives the space-time of the resultant system from this interaction, which is conventionally described as *elastic collision* (closed conservative system):

$$E = E_1 E_2 = m_1 v_1 m_2 v_2 =$$

$$= SP(A)_1[1d\text{-}space\text{-}time]_1 \times SP(A)_2[1d\text{-}space\text{-}time]_2 = \text{m}v^2 \quad (26),$$

where $m = m_1 m_2 = S(P)A$, and $v^2 = v_1 v_2$ according to AR (e.g. $3^2 = 1{\times}9$, where $v_1 = 1$, $v_2 = 9$ and $v = 3$), or in short:

$$E = SP(A)[2d\text{-}space\text{-}time] = E_A f \quad (27)$$

Equation (27) is another equivalent presentation of the Law within the geometric formalism of traditional physics and can be substi-tuted by any other spatial presentation. It demonstrates the possibi-lity of expressing the Law with descriptive terms of mathematical character. As most traditional laws are derived within geometry by employing AR, one frequently encounters this two-dimensional expression of space-time in physics, for instance, as the quantity „*work*" $W = Fs = SP(A)[2d\text{-}space\text{-}time]$, where

$$F = ma, \ m = SP(A), \ a = \text{d}v/\text{d}t = [1d\text{-}space\text{-}time] f,$$

$$s = [1d\text{-}space].$$

When we substitute v with c in eq. (26), we obtain Einstein's fa-mous equation on the equivalence of mass (space-time relationship)

and energy (space-time): $E = mc^2$. According to PCA, this equation is an application of the Law for the space-time E of any system, given in relation to the reference space-time $c^2 = [2d\text{-}space\text{-}time]$ of the photon level $m = SP(A) = E/c^2$. The space-time of any system E can be compared to the space time of the photon level $E_p = m_p c^2 = c^2 = [2d\text{-}space\text{-}time]$, when the photon mass m_p is defined as „1 unit" or the „certain event" $m_p = SP(A) = 1$. This mathematical approach reveals why photon mass has been <u>neglected</u> in physics - it is already in the velocity of light as a system of reference. The same formalistic blunder has been accomplished with respect to the current definition of charge and current by assigning the *cross-sectional area A* of the conductor the number „one" and then omitting it in the mathematical presentation of the current $\Delta I = \Delta Q/A\Delta t$, when $A = 1$, $\Delta I = \Delta Q/\Delta t$. In physics, the square speed is also defined as *potential* or *gradient* (see *LRC* below). From equation (27), we obtain the following axiomatic presentation for the **action potential** within geometry:

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

$$= SP(A)[1d\text{-}space\text{-}time][1d\text{-}space] \tag{28}$$

The two-dimensional presentation of the space-time of the resultant system is a product of the one-dimensional expression of the space-time of the interacting entities as *momentum*. Two vectors described as lines are multiplied according to AR to give a vector product. This geometric quantity is presented as „**area**", when the time of the resultant system is set as $f = 1$. Alternatively, space-time exchange can be regarded as an action potential and presented as „**area in motion**" within geometric formalism. This presentation results from the method of measurement in Euclidean space. It can be substituted by any [$n\text{-}d\text{-}space$]-presentation. Many conventional laws and definitions of physical quantities follow intuitively (subconsciously) the paradigm „area in motion" - for instance, electric current is defined as „charge (area) in motion" (see below).

3.19 Charge is Area - "Area in Motion" Is Electric Current (Action Potential)

„**Area in motion**" is an intuitive notion of the Law within geometry, which is frequently used in the formulation of specific laws. For instance, the laws of electricity are ontologically derived from this paradigm. It can be proven that *charge*, another fundamental term of physics, is a synonym for *area*, while the SI unit for charge „1 *coulomb*" is equivalent to „1 *square meter*". This crucial tautology has been overlooked by all physicists so far. In a vicious circle, the quantity *electric current* is then defined as an „area in motion". This quantity is a subset of the new term „action potential" (eq. 28). This fundamental formalistic blunder is the topic of a separate publication. Here, we shall present its final mathematical result obtained within the new axiomatics, which proves in an irrevocable manner that the *elementary charge e* is a hidden definition of „geometric area" and that the SI unit „*coulomb*" is a synonym for „*square meter*" without discussing all the steps and formalistic considerations that have led to this fundamental equation:

$$ e = 2\pi^2 f_{c,e} \left[\frac{\lambda_{c,e}}{\lambda_A} \right]^2 = \left[2d - space \right] = 1.6 \times 10^{-19} m^2 \qquad (29), $$

where $\lambda_{c,e}$ is the *Compton wavelength of the electron*, which is a known natural constant, $f_{c,e}$ is the *Compton frequency of the electron* $f_{c,e} = c/\lambda_{c,e}$ and λ_A is the *wavelength of the basic photon h* (*Planck's constant*) when $f = 1$ within mathematical formalism: $c = f\lambda_A = \lambda_A$.

3.20 The Long Range Correlation (*LRC*) is a New Quantity of Great Practical Relevance

Within the new axiomatics, a new term is introduced, called the „**long range correlation**" (***LRC***). It is *square velocity* as obtained by AR within geometry $v^2 = v \times v = LRC$. It assesses space-time from the static point of view:

$$E_{static} = [2d\text{-}space\text{-}time] = long\ range\ correlation\ (LRC) =$$

$$gradient = potential \hspace{3cm} (30),$$

when $SP(A) = 1$. The term „long range correlation", which is also used in traditional physics, acquires a new clear-cut definition. The quantity *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 and energy exchange is mentally ignored. The method of definition (= method of measurement) of this abstract quantity is mathematics. In this case, the mass (energy relationship) of any particular system is described as the certain event $SP(A) = m = 1$ or 1 *unit* and is not expressed in the equation.

We introduce this term for practical reasons - there are many different quantities in physics that are synonyms for *LRC*. For instance, the quantity *electric gradient* or *potential* is a concrete *LRC*. It assesses the space-time of the systems as a potentiality that can be transformed into an actuality, that is, into energy exchange by the free will of our mathematical consciousness. This discrimination occurs in the mind and not in the real world - space-time is incessant energy exchange. According to AR, any system of space-time can be assessed as a result of the interaction between two other systems and any assessment is an interaction *per se*. We may assume that a system is not interacting (closed system); for example, we may take a capacitor potential that does not discharge. In this case, we can only describe its space-time, if we compare it with itself in an abstract way. Any other measurement, for example with a voltmeter, will be a discharge, no matter how infinitesimal. How-

ever, a self-comparison is also an interaction - it is a metaphysical interaction that occurs in the mind by means of mathematics. If we describe the system with the quantity mass, we can set its mass in relation to itself and obtain the certain event within mathematics by applying PCA: $m/m = SP(A) = 1$. As we have shown above, this is the actual definition of „mass at rest". As all systems are in motion, there is no such thing as „mass (or energy) at rest". This quantity is a mathematical convenience, „a definition by abstraction", and merely expresses the „certain event" in mathematical physics.

3.21 The Axiom on the Reciprocal Behaviour of Contiguous *LRCs* of a System

According to AR, any system can be regarded as consisting of two levels (U-subsets). The space-time of these levels can be expressed as *LRC*. In this case, the two *LRCs* of the system manifest the reciprocity of space and time. While the *LRC* of the first level increases, the *LRC* of the second level decreases and vice versa. This also follows from the axiom of CAP, which is another equivalent statement on the reciprocity of space and time. The reason for this reciprocal behaviour of contiguous gradients is that the space-time of the system is constant - it is a U-subset of the constant and closed space-time. This approach is very useful in describing the dynamic behaviour of real systems. This axiom has been used to explain for the first time the biological regulation of the cell and the organism from a dynamic, kinematic point of view (22).

The reciprocal behaviour of *LRCs* has been anticipated in mathematics by the introduction of negative numbers, which are complementary to the continuum of real numbers. We can assign any real positive number an equivalent negative number. Thus the continuum is designed as a formal system, which constitutes two levels that behave reciprocally - the continuum of positive numbers and the continuum of negative numbers. Zero (von Neu-

mann's set) is an abstract limit (intercept) between the two sets, but this symbol can be replaced by any other number.

3.22 The New Quantity „Structural Complexity, K_s"

Modern physical outlook on nature is dominated by *wave-particle dualism*. In fact, it is a dualism of the static and dynamic point of view of human perception. This dualism is not a real property of space-time, as is generally believed today, but an abstract mathematical discrimination. Space-time exchange is <u>always</u> dynamic - its universal manifestation as perceived by human senses and the mind is **motion**. The dynamic view is thus the only correct perception of space-time, as has been proven in the theory of relativity. The static view is an abstract idea (object of thought) based on a „mathematical trick", which has not been fully comprehended so far. In the new axiomatics, this universal, more or less, intuitive procedure is called „**the arrest of time in human mathematical consciousness**". To this mental phenomenon, we owe the very existence of geometry and mathematics, and their ability to assess the phenomenology of space-time in an adequate manner. The mathematical origin of the physical world and of all natural sciences stems from the automatic arrest of time f within trivial and mathematical thinking. Without this mathematical „Pavlov's reflex", humans will not even be in the position to perform simple counting of real objects.

For instance, the water current, itself, cannot be counted, because it is not a fixed, static quantity. Only after we describe it as a static entity, e.g. as a river or a stream, can we count it, so that we can now ask the following question: „How many rivers flow through this county"? From this example, it becomes cogent that human language, the very ontology and semantics of its vocabulary, is intrinsically linked to this intuitive procedure of mathematical consciousness. It can be shown that most of the semantic and logical confusion, which one encounters in science and philosophy, stems from the lack of apprehension of this fundamental,

ubiquitous phenomenon of the human mind. From this elaboration, we can succinctly conclude, that the epistemological arrow of all human knowledge - be it scientific or trivial - points from the mind towards the outer world and not vice versa, as the currently predominant empiric view sustains. This proves the priority of idealism over empiricism.

Purely for this reason, a new quantity is introduced in the new axiomatics that expresses the static physical view. It is called „**structural complexity**" (K_s). This quantity is an abstract subset of space-time and is defined as the total set of <u>all</u> static perceptions in physics, science, and philosophy. It is established in an abstract way in the mind when the constituent „*time*" is theoretically *arrested*. The arrest of time occurs within mathematical formalism by assigning it the number „1" as 1 *unit* or the certain event $f = 1$ in an *a priori* manner:

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

$$= SP(A)[2d\text{-}space]\, f^{\,2} = \textbf{energy} \qquad (31)$$

When *time* $f = 1$:

$$K_s = SP(A)[2d\text{-}space] = \textbf{area relationship} =$$

$$= \textbf{structural complexity} \qquad (32)$$

Time is the constituent of space-time that assesses energy exchange quantitatively: $E \approx f$. Therefore, the universal equation $E = E_A f$ assesses space-time from the dynamic point of view. K_s assesses the other constituent, *space* (extent), which stands for the static view. Within geometry, it is usually defined as an *area relationship*, just as mass is defined as a space-time relationship. K_s embodies the **geometric** approach to space-time as static space, e.g. Euclidean space, Minkowski's world, Hilbert's space, etc. It is cogent that the very definition of K_s eliminates energy as a concept.

Precisely for this reason, all the above mentioned geometric spaces, being widely used in physics, are <u>empty</u>: They are void of energy - they are mental abstractions of real space-time, which is incessant, continuous energy exchange. This impeccable axiomatic conclusion explains for the first time, why physicists have no idea, what energy is (6), notwithstanding the fact that the natural science, they practice, is a classical study of energy interactions. By introducing an ever-growing mathematical complexity into the empty geometric spaces of their theoretical and experimental elaborations, physicists have completely forgotten to take a fresh look upon real space-time, the actual object of their study. Thus they have resorted to the utmost form of blind empiricism - to a profound agnosticism with respect to the epistemological foundations of modern physics.

This irrevocable axiomatic finding explains for the first time, why we encounter many different quantities in physics that are erroneously believed to be intrinsic properties of matter, but are, in fact, hidden synonyms (pleonasms, tautologies) of K_s. The most prominent is *charge* $Q = K_s = area$. When we set [*2d-space*] $= SP(A) = 1$, we can express $K_s = SP(A)$. Therefore, we can also express charge (area) as $Q = SP(A) = n$ within mathematical formalism. This formalistic approach can be illustrated with the following simple example: The area of a soccer field ($100 \times 50m$) is a ratio to the arbitrary unit area of $1m^2$, which can either be expressed as a number $n = SP(A) = 5000m^2/1m^2 = 5000$ in mathematics or an *area* = [*2d-space*] in geometry. Alternatively, we can substitute the meter with an *inch*, the relationship between the two areas, the soccer field and the square meter, remains the same. This example cogently confirms our basic axiomatic conclusion that, according to PCA, all physical quantities are obtained as numerical dimensionless relationships between two real systems (application of CAP and AR), one of them being usually defined as a *reference system*, and are thus <u>independent</u> of the choice of the reference unit. This leads to the elimination of the SI system in the mathematical presentation of physical quantities, which are adequately

defined by the new space-time symbolism (see Table 2). From this disquisition, it can be concluded that the new quantity K_s effects another great cognitive simplification in our physical outlook, as is summarized below:

$E = E_A f = SP(A)[2d\text{-}space\text{-}time]$ -   **Universal equation**, <u>dynamic</u> expression of space-time

$K_s = SP(A)[2d\text{-}space], f = 1$ -   **Structural complexity**, <u>static</u> expression of space-time

$E_A = K_s f = SP(A)[2d\text{-}space] f$ -   **Action potential** (*area in motion*), <u>dynamic</u> expression of space-time

The three basic equations of the new axiomatics express the *dynamic-static view* of the world as embodied in the *wave-particle dualism* in physics. They show that the constituent „time" assesses the primary term dynamically as energy exchange (motion), while the constituent „space" assesses it statically in terms of geometry.

3.23 Every Motion in Space-time is Rotation

Space-time is <u>closed</u>. The closed character of the primary term is manifested by its U-subsets (systems, levels), which contain the nature of the primary term as an element. Thus, any motion, being the universal manifestation of energy exchange, is also closed. Within mathematical formalism it can be described as **rotation**, e.g. as a circular or elliptical motion. Any rotation can be regarded as a system or an action potential. The *static* mathematical expression of such rotations makes use of circles (e.g. wave func-

tion), ellipses (Kepler's laws), or any other closed geometric figure - hence the frequent use of the transcendental *pi*-number in physics, e.g. $h/2\pi = \hbar$.

As all U-subsets of space-time are open, all rotations are *superimposed*. The *principle of superposition* (electromagnetism and quantum mechanics) reflects the open character of the systems. *Translation* is a mathematical abstraction of rotation with a very large extent: when [*space*]$\rightarrow\infty$, [1*d-space*]$\rightarrow$ *straight line*. This is the <u>abstract</u> origin of the co-ordinate system of Euclidean space or of any other geometric space based on straight lines and right angles. The closed character of space-time determines the interception of parallel lines in infinity in an *a priori* manner (rejection of the parallel axiom). The proof of existence is the conservation of energy. This proof cannot be given within geometry. On the other hand, it can be shown that not only classical mechanics (Newton's laws for rotations and wave equations) and electromagnetism (Maxwell's four equations), but also quantum mechanics (Bohr's model, Schrödinger wave equation) assess the micro- and macrocosm as superimposed, closed rotations within geometry. The theory of relativity is, for instance, based on the notion that space is bent (curved) by gravitation. In such a space, there can be no straight lines or right angles, and the „parallel axiom" is not valid. This knowledge effects another great simplification in our physical outlook.

Finally, it is important to observe that there is no way of discriminating between rotations and waves in real terms. When a rotation is regarded as a solitary event, while the other superimposed rotations are neglected in an abstract manner, the centre of rotation is considered a fixed (motionless) point. In this case, we describe a closed rotation, such as a circular motion. For instance, by disregarding the rotation of the earth around the sun, we can present the earth's revolution around its own axis as a closed rotation. When the elliptical rotation of the earth around the sun is considered, the path of any earth's point represents a wave. As all rotations are superimposed, we only have waves. Hence de Broglie's

correct notion of the *wave character of matter*. This axiomatic knowledge effects another great simplification in physics.

3.24 The Continuum of Transcendental Numbers is the only Adequate Perception of Space-time

Any mathematical expression of space-time is based on real numbers. For instance, the transcendental number *pi* is expressed as a real number $\pi \cong 3.14$, which is an arbitrary approximation. All physical quantities in physics, e.g. all natural constants, are expressed in terms of real numbers, which are mathematical approximations of real magnitudes. Mathematics has virtually no theory of how to use transcendental numbers for practical applications. This fact is of great theoretical importance. Real numbers are N-sets - they exclude themselves as an element. For instance the set of all „2" numbers is „1 set" and not „2 sets". The number „2" excludes all numbers that approximate 2, e.g. 2.000000001. Such numbers are called „**closed numbers**" analogously to the closed systems in physics. They exclude all contiguous approximations along the continuum. On the other hand, *transcendental numbers* are defined as „**open numbers**" - each transcendental number, such as *pi*, contains infinite approximations, which are closed real numbers. All systems of space-time are open U-subsets of space-time.

Thus, the only adequate presentation of real U-subsets of space-time within mathematics should be the use of **open transcendental numbers**. These numbers adequately assess the continuousness and infinity of space-time. The *transcendence* (*discrete continuousness*) of real-space-time must be reflected by a new mathematics of open transcendental numbers that should be developed in the near future.

This insight has been intuitively followed in the past. For instance, in the *theory of sets* the continuousness and infinity of the continuum (tautology due to PLE) is proven with the existence of

transcendental numbers, which cannot be counted (12). In a vicious circle, the continuum of transcendental numbers is then visualized by means of the continuousness of the infinite points on a straight line, although neither „point" nor „straight line" can be defined within geometry (10). In the new axiomatics, the existence of transcendental numbers is proven with the transcendence (continuousness and discreteness) of space-time (proof of existence in the real world).

For obvious reasons, all the numerical results which we present in the General Theory of Natural Sciences (2-5, 21-25) are real closed numbers - they are mathematical approximations, reflecting the current degree of precision in the measurement of physical quantities. The method of measurement of modern physics is based on the *a priori* decision to employ exclusively the continuum of closed real numbers. This is accomplished by assigning any real system of reference the primary closed number „1" as 1 *unit* in the SI system, e.g. 1 *kg*, 1 *joule*, etc., or as the certain event $SP(A) = 1$, e.g. in the *standardisation condition* of *Schrödinger wave equation* in quantum mechanics, in the theory of relativity as shown above, and so on.

According to PCA, all physical magnitudes are measured and expressed as relationships to this number and are therefore closed real numbers $n/1 = n$. Thus the precision of any experimental result is predetermined by the method of definition of the quantities and their units (objects of thought), which is pure mathematics. For this reason, all numerical results of constants and other physical quantities presented in the new integrated physical and mathematical theory of the Law merely reflect the current method of definition and degree of precision of measurement in experimental physics. Their exactness is, however, irrelevant to the validity of the new axiomatics. Nonetheless, the accuracy of these numerical results is a powerful evidence for the ubiquitous validity of the new axiomatics.

ABBREVIATIONS

AR   -   Axiom of Reducibility
CAP   -   Conservation of Action Potentials,
                axiom of
K_s -   Structural complexity
Law   -   Universal Law
LRC   -   Long-Range Correlation
PCA   -   Principle of Circular Argument
PLE   -   Principle of Last Equivalence
RT   -   Rule of Three (universal equation)
UE   -   Universal Equation

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