

## The Logical Analysis of the Special Theory of Relativity: Lesson for Nobel Laureate in Physics

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**Abstract:** The correct theoretical analysis of the generally accepted foundations of the special theory of relativity is proposed. The principle of the unity of formal logic and dialectics is a methodological basis of the analysis. The result is as follows: the foundations (i.e., the interpretation of Michelson-Morley's experimental data and calculations, the contraction hypothesis and the Lorentz transformation formulae, concept of space-time, Einstein's formula expressing equivalence of mass and energy) contain logical errors and are not the consequence of any postulates. The existence of logical errors is irrefutable proof of incorrectness of the special theory of relativity. The following correct theories and principles are proposed: theory of time; theory of space; the quantum theory of constancy of light speed; the principle of equivalency of mass and energy; the principle of objectivity of human knowledge; the theory of system of reference.

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*"Even if you don't like its (STR's) logic, the Special (and the General) Theory of Relativity works remarkably well. The only changes you can bring about is in the names you attach to things. I don't care much about that"* (Professor Gerard 't Hooft, Nobel Laureate in physics). Let us object.

### 1. Introduction

As is known, physics plays an important role in the development of science and technology. But the significant success of theoretical physics and the perfection of its mathematics "hide from our view weight of those sacrifices which have been made for this success" (A. Einstein). Now it becomes obvious that the truth is a name of these sacrifices [1--31]. The existence of the problem of truth in theoretical physics means that physics enters the greatest crisis. Inevitability of the greatest crisis is corroborated by the fact that the foundations of theoretical physics (i.e. thermodynamics, statistical physics and physical kinetics, the special theory of relativity, quantum mechanics) include the set of logical errors [1--31]. Errors are a collateral and inevitable result of inductive method of knowledge of the Nature, i.e. result of movement from formation of separate concepts to formation of the system of concepts. The inductive way of development of physics is characterized, for example, by A. Einstein's words: (a) *there has been formed a view that the foundations of physics were finally established and the work of a theoretical physicist should be to bring a theory in correspondence with all the time increasing abundance of the investigated phenomena. Nobody thought that a need for radical rebuilding of the basis of all physics could arise;* (b) *but the progress of science will cause revolution in its foundations. Our notions of physical reality never can be final ones. We should be always ready*

*to change axiomatic basis of physics to substantiate facts of perception in logically most perfect form.* In this context, “the progress in science is underlining difficulties” (N. Bohr).

Larmor-Lorentz-Poincare-Einstein’s special theory of relativity (STR) “played particularly important role in modern physics. Necessity of periodic change of basic principles of physics was shown for the first time in this theory” (V. Heisenberg). Change of principles of science is always accompanied by broadening of scientists’ consciousness, and broadened consciousness promotes deductive revision of foundations of science. At the same time, the STR brought the paradoxes in theoretical physics. In my opinion, paradoxes are not properties of real phenomena. The paradoxes are consequence the starting-point and basis of the STR, therefore, they are the inalienable part of the STR. Today all physicists know this theory, many analyze critically consequences of it, but only some are aware of instability of the basis of the theory. The starting-point and basis of the STR were logically analyzed in the original works [1--6, 8, 11, 15, 17, 18]. The purpose of the present work is: (a) to propose the thorough logical analysis of the foundations of the STR and to prove that the generally accepted interpretation of Michelson-Morley’s experimental data and calculations, the contraction hypothesis and the Lorentz transformation formulae, concept of space-time, Einstein’s formula expressing equivalence of mass and energy represent logical errors; (b) to define the following concepts: the concept of time; the concept of space; the concept of objectivity of human knowledge; the concept of system of reference; (c) to explain correctly the principle of constancy of the speed of light; (d) to formulate correctly the principle of equivalency of mass and energy.

## **2. Methodological Basis for the Theoretical Analysis**

Modern theoretical physics consists of the set of theories but does not contain criterion of the truth of physical theories. In my opinion, lack of the criterion of the truth of theories in theoretical physics is explained by the fact that the system of physical (i.e. special scientific) concepts and laws is incomplete: it does not include many universal (i.e. the general scientific) concepts and laws. The complete system – the system of physical concepts and the laws supplemented with the system of universal concepts and laws – would represent not only basis of physics but also methodological basis for the deductive analysis of physics. From this point of view, the unified criterion of the truth of physical theory should be formulated as follows: a physical (i.e. special scientific) theory must not contradict the system of the universal (i.e. general scientific) concepts and laws. The system of the universal concepts and laws represents a unity of formal logic and dialectics. And this unity is a science of most general laws of development of the Nature, human society, and correct thought. Consequently, this system is a methodological basis for a critical analysis of physical theories.

Thus, the principle of the unity of formal logic and dialectics is a correct methodological basis for the proposed theoretical analysis of the STR.

## **3. The Logical Analysis of the Special Theory of Relativity**

The results of the logical analysis of the STR are as follows [1--6, 8, 11, 15, 17, 18].

- (1) The statement that there exist the contradiction between the experimental and calculated data of Michelson-Morley is a starting-point of Larmor-Lorentz-Poincare-Einstein’s STR. One can understand cause of this contradiction on the basis of the following idea. The

Earth and the Sun are in a relative motion ( $\vec{V}$  is the velocity of the relative motion). It means that the Earth is a moving system of reference **E** only in the Sun system of reference **S**, and the Sun is a moving system of reference **S** only in the Earth system of reference **E**. The Michelson-Morley interferometer and an observer (doing measurements and calculations) are in the Earth system of reference **E**. Consequently, the interferometer and the observer are in the resting system **E**. In accordance with the logic law of identity,

the comparison of experimental and calculated data with each other must be done in the resting system **E**.

- (2) The contradiction between the experimental and calculated data of Michelson-Morley is due to that the fundamental comparison between them was done incorrectly. Really, the experimental and calculated data belong to essentially different systems of reference: the experimental data belong to the reference system **E** related immobility with the Earth, and the calculated data containing the velocity  $\vec{V}$  of the motion of the Earth belong to the reference system **S** related immobility with the Sun. Therefore, the comparison of this data with each other is the first and principal logical error. This error leads inevitably to the contraction hypothesis and its mathematical representation – the Lorentz transformation formulae
- (3) The experimental and calculated data of Michelson-Morley are in complete agreement with each other if they belong to one and the same reference system **E** related immobility with the Earth. From viewpoint of logic, it means that the contraction hypothesis and the Lorentz transformation formulae are not in agreement with Michelson-Morley's experiments and formulae. In other words, the incorrectness of the contraction hypothesis and of the Lorentz transformation formulae is proved by the experimental data.
- (4) In accordance with the generally accepted opinion, the Lorentz transformation formulae are a consequence of the postulates of the STR. (First Postulate: The speed of light in vacuo is the same to all inertial observes. Second Postulate: Every physical theory should look the same mathematically to every inertial observer). However, one can prove erroneousness of this opinion.
- (4) The true sense of the Lorentz transformation formulae becomes apparent if one takes into consideration the following statements: firstly, the standard method of deduction of Lorentz's formulae is the method of introduction (insertion) of the Galilean transformation into the equation of the front of the light wave; secondly, the principle of existence and of transformation of coordinates reads as follows: there are no coordinates and no transformation of coordinates in general, and there exist the coordinates and transformation of the coordinates of the object only. Really, the true sense is revealed as follows. (a) The front (i.e. the point) of the light beam (for example, in the Michelson-Morly interferometer) is the physical object **L**. The equation of the front of the light beam in the system of reference **S** (i.e. the Sun) is given by the expression:  $x_L = ct$ ,  $c = const$

where  $\vec{c}$  is the velocity of light in vacuo (light is propagated in the positive direction of the axis  $Ox$ ),  $c = const$  is the mathematical expression of the principle of constancy of light speed (i.e. the first postulate of the STR; it is the postulate of the Michelson-Morley calculations as well),  $t$  is time. (b) The material point (for example, Michelson-Morly interferometer's mirror which is in the system of reference **E** (i.e. the Earth)) is the object **M**. The Galilean transformation represents the relation of the coordinate  $x_M$  of the point **M** in the system **S** to the coordinate  $x'_M$  of the point **M** in the system **E**:  $x_M = Vt + x'_M$

where  $\vec{V}$  is the velocity of motion of the system **E** relative to the system **S** in the positive direction of the axis  $Ox$  ( $V < c$ , in accordance with the principle of constancy of light speed, speeds  $V$  and  $c$  are physically independent). (c) Introduction (insertion) of the Galilean transformation into the equation of the front of the light beam means equality between the coordinates:  $x_M(t) = x_L(t)$ . The equality between the coordinates of the objects **M** and **L** means an intersection of mathematical objects with each other. Hence, the physical meaning of the equality  $x_M(t) = x_L(t)$  is that it express the coincidence of the physical objects **M** and **L** with each other. And the inequality  $V < c$  is the necessary kinematic condition of this coincidence. (d) If  $x_M(t) = x_L(t)$  is an equation in the

unknown  $t$ , then a solution is given by the Michelson-Morley formulae:  $t = D/(c - V)$  (in the system **S**) and  $t = D/c$  (in the system **E**) where  $D$  is the length of the interferometer's shoulder. (e) The statement that the equalities  $x_M = x_L$  (in the system **S**) and  $x'_M = x'_L$  (in the system **E**) must be valid at any moment of time results in the Lorentz transformation formulae:  $x_M = \gamma(x'_M + \beta x'_L)$ ,  $x_L = \gamma(x'_L + \beta x'_M)$  where  $x_L = ct$ ,  $x'_L = ct'$ ,  $\beta \equiv V/c$ , and  $\gamma \equiv (1 - \beta^2)^{-1/2}$  is the contraction factor. This equalities are not consequence of the postulates of the STR. (f) From the Lorentz transformation formulae, it follows that the equalities  $x_M = x_L$  and  $x'_M = x'_L$  are valid at any moment of time. Hence, the physical meaning of the Lorentz formulae is that they express the coincidence of the objects **M** and **L** (moving with different speeds) with each other at any moment of time. However, such picture of coincidence is physically impossible.

- (5) Michelson-Morley's formulae represent conditions that individual light point **L** consists with interferometer's mirror **M** at the certain (only one) moment of time. Therefore, the spatial coordinates of the point of coincidence and the time of coincidence are constant in those formulae. Such picture of coincidence is physically correct.
- (6) The second logical error is that the spatial coordinates of the point of coincidence (intersection) and the time of coincidence are variable quantities in the Lorentz transformation formulae. From viewpoint of the Michelson-Morley experiments, this error means that the individual light point **L** consists with the mirror **M** at any moment of time. Consequently, the Lorentz transformation formulae represents neither physical nor logical consequence of the postulates of the STR. Moreover, the second logical error results in appearance of a relation of the spatial coordinates to the time. This relation leads to concept "space-time". But the existence of such relation is in conflict with: (a) the principle of constancy of light speed (because a mirror can be always considered as a light source or light receiver); (b) the essence of time [4, 11]; (c) the essence of space [15].
- (7) The third logical error is that the Lorentz transformation formulae include the contraction factor  $\gamma$ . The contraction factor  $\gamma$  transmutes physically independent motions – the motion of the mirror **M** (i.e., of the light source or light receiver) relative to the Sun and the motion of the individual light point **L** – into physically dependent motions. Because of it, the dependence of the speed  $V$  of the mirror upon the speed  $c$  of the light appears and has the form  $(1 - \beta) > 0$ ,  $\beta \equiv V/c < 1$ , i.e. speed limit appears in physics. Moreover, the spatial and time intervals become dependent on  $V$ . However, from viewpoint of the Michelson-Morley experiments and calculations, the true sense of the inequality  $V/c < 1$  is that it express the necessary kinematic condition of coincidence of the objects **M** and **L** at the certain (only one) moment of time.
- (8) The principle of constancy of light speed (i.e. the first postulate of the STR) is valid in any arbitrary system of reference. Really, if the speed of light in vacuo is independent of the speed of light source or light receiver, then it is also independent of change of speed of light source or light receiver. However, the STR – a classic theory – cannot explain the principle of constancy of light speed.
- (9) The constancy of light speed is explained by the fact that the light is not a material point of classical mechanics, and it is a set of quantum particles – photons. The motion of any quantum particle (in particular, photon) relative to a system of reference is the absolute motion [3, 5, 8, 12, 13, 18--20]. The absolute motion is invariant under choice a system of reference (it means that the velocity addition theorem is not valid).
- (10) Einstein's mass-energy relation  $E = mc^2$  (where  $E$ ,  $m$  are the internal energy and the mass of the material point, respectively) is incorrect because the multiplication of the quantities  $m$  and  $c^2$  characterizing not one and the same (unitary) object but the different (physically independent) objects **M** and **L** is a logical error [6, 9]. Therefore, this relation represents the fourth logical error.

Thus, from the above, it follows that: (a) the foundations of the STR contradict the experimental data and contain the logical errors; (b) the existence of the logical errors are irrefutable proof of incorrectness of the STR; (c) lack of exact definitions of the concepts “time”, “space”, and “system of reference” in modern physics is the main cause of the fact that absolute incorrectness of the STR was not proved up to now. In this connection, one should solve the following problems: first, the concepts “time”, “space”, and “system of reference” should be exactly defined; second, the principle of constancy of light speed ( $c = const$ ) should be explained; third, the principle of equivalence of mass and energy should be correctly formulated.

#### 4. The Theory of Time

The new theory of time [4, 11] representing a new viewpoint that has arisen from the critical analysis of the foundations of physics and philosophy is proposed. The principal idea leading to the theory is that the concept of motion furnishes the clue to understanding of the essence of time. The theory is formed by the following statements [4, 11].

(1) Motion is change in general.

(2) Motion is a sequence of transitions of some states into others.

(3) The origin and the end of the motion are the informational characteristics of a motion. They determine the direction and the duration of the motion; a direction and a duration characterize a motion.

(4) The duration of the motion is the sum of the duration of the individual transitions. Motion is called uniform motion, if the each duration of the individual transitions is the same constant quantity.

(5) If motion is uninterruptedly reiterated several times, then it is called uninterruptedly reiterating one.

(6) Uninterruptedly reiterating motion is called cyclic motion if the origin of the next motion coincides with the end of the previous motion. Cyclic motion is characterized by frequency  $\nu$  – the number of cycles per the unit duration. The  $\nu$  is the nonphysical, informational characteristic of the cyclic motion.

(7) Cyclic motion is called unlimited cyclic motion if the number of cycles is unlimited one.

(8) The motion is called clock-motion if: (a) it is a cyclic, uniform, stable (i.e.  $\nu = const$ ), unlimited motion and it does not interact with the surroundings; (b) it is a universal measure of other motions; c) the duration of the motion is described by the expression  $t_i = i\tau$ ,  $i = 0, 1, 2, \dots$  where  $\tau = const$  is the duration of each individual transition,  $i$  – the number of individual transitions. The elementary duration  $\tau$  can be chosen as small as desired.

(9) The macroscopic device realizing the clock-motion and giving the information  $t_i$  to each arbitrary observer is called clock. Consequently, a quantum particle does not represent a clock.

(10) A clock is a human-created macroscopic device noninteracting with the surroundings (i.e. other physical objects). It is the inalienable part of the system of reference. (As is known, the first clock – elementary water-clock and sun-dial – was built in Ancient Babylon, Ancient Egypt, and Ancient East. Sun-dial was introduced into everyday life by Ancient Greek philosopher Anaximander (c. 610--546 BCE). The clock consisted of a vertical rod installed on the marked horizontal platform. Day time was defined by the direction and the size of the rod shadow).

These statements lead to the following definition of the essence of time:

(a) a clock determines a time, and a time characterizes a clock;

(b) a time is not a physical or geometric property of natural objects and phenomena. Therefore, a time has no physical or geometrical meaning. In this sense, a time does not exist;

(c) a time exists in the other – only informational – sense: the time  $t_i$  defined by a clock is the form of the information characterizing the physical motion in a clock;

(d) from mathematical point of view, the  $t_i$  is the human-created independent variable quantity representing the informational parameter of the system of reference. Since the

elementary duration  $\tau$  can be chosen as small as desired, one can consider  $t_i$  the continuous variable quantity  $t$ ;

(e) from general-scientific point of view, the time  $t_i$  represents the universal informational basis for ordering of information about processes in the world;

Consequence of mutual independence of physical objects and of a clock is as follows: mathematical operations on physical quantities (characterizing the physical objects) by time is permitted by the logic laws because the “physical objects + system of reference” is a united system which consists of physically noninteracting subsystems.

Thus, time is an independent variable quantity characterizing human-created informational basis. Therefore, the concept of time has only informational meaning.

#### 4. The Theory of Space

The new theory of space [15] representing a new viewpoint that has arisen from the critical analysis of the foundations of physics, mathematics, cosmology, and philosophy is proposed. The main idea following from the analysis is that the concept of motion furnishes the clue to understanding of the essence of space. The starting-point of the theory represents the following philosophical (dialectical) principles and categories [15].

(a) The principle of the materiality of the Nature: the Nature (the Universe) is a system of material objects (particles, fields, bodies); each object has properties (i.e. qualitative determinacy); the properties are inseparable characteristics of material object and belong only to material object.

(b) The principle of the existence of material object: an object exists as the objective reality, and motion is a form of existence of object.

(c) The principle of motion of object: the motion is quantitative change of qualitative determinacy of object, i.e. the motion is a sequence of transitions of some states into others. Motion determines a direction, and direction characterizes the motion.

(d) The category of measure: the measure is the philosophical category meaning unity of the qualitative and quantitative determinacy of the object.

(e) The category of state: the state is the philosophical category meaning element of measure of the object. Measure is a set of the states of the object.

(f) The category of mathematics (geometry): mathematics is quantitative description of properties abstracted from material objects. Mathematics studies the quantitative determinacy separated from qualitative determinacy of the material (physical) object. Therefore, mathematics has no physical meaning.

These principles and categories lead to the following statements expressing the essence of space.

(1) There is no space separated from material object, and there is space only as a form of existence of the properties of the object. It means that the space is a set of the states of the object. Concepts “measure”, “state”, and “space” are identical ones.

(2) The states of the object are manifested only in a system of reference. The main informational property of the unified system “researched physical object + system of reference” is that the “system of reference” determines (measures, express, calculates) the parameters of the subsystem “researched physical object” (for example, determines the coordinates of the object **M**); the parameters characterize the “system of reference” (for example, characterize the system of coordinates).

(3) The parameter of the object is the mathematical (quantitative) expression of its measure in the “system of reference”. Total number of the mutually independent parameters of the object is called dimension of the space of the object.

(4) The set of numerical values (i.e. the range, the spectrum) of the parameter is the subspace of the object. (The coordinate space, the momentum space, and the energy space are examples of the subspaces of the object).

(5) The set of the parameters of the object is divided into two opposite classes: the class of the internal parameters (expressing, for example, the physical states of the object) and the class of

the external parameters. The class of the external parameters is divided into two opposite subclasses: the subclass of the absolute (proper) parameters (expressing the form, the sizes of the object) and the subclass of the relative (non-proper) parameters (expressing the positions, the coordinates of the object relative to other objects).

(6) Set of the external parameters forms the external space of object. It is called geometrical space of object if this space represents set of the positions, the coordinates of the object .

(7) Since a macroscopic object has three mutually independent sizes, the dimension of its external absolute (proper) space is equal to three. Consequently, the dimension of its external relative (non-proper) space is also equal to three.

(8) In general case, the internal space, the external absolute space, and the external relative space of the object are mutually dependent because of influence of a medium (i.e. because of physical interaction between the object and surroundings – other physical objects). The geometrical space of such object is called non-Euclidean space. If the internal space, the external absolute space, and the external relative space of some object are mutually independent, then the external relative space of such object is the homogeneous and isotropic geometrical space. The geometrical space of such object is called Euclidean space of the object.

Consequence is as follows: external spaces of material objects of the Universe are not described by unique geometry, therefore, the question of the Universe true (only one) geometry is incorrect.

Thus, the concept of space has only the following sense: space is the set of the states of object. Geometry describes properties abstracted from material objects and, therefore, the geometrical space has no physical meaning.

## 5. Quantum Theory of Constancy of Light Speed

The principle of constancy of light speed can be explained within the framework of a new quantum theory. The basis of the new quantum theory representing a new viewpoint that has arisen from the critical analysis of statistic physics, the special theory of relativity, and quantum mechanics was proposed in works [6, 7, 12, 19, 20, 22]. The basis is formed by the following heuristic principles [6, 7, 12, 19, 20, 22].

(1) The principle of motion of quantum particle: the motion is the form of existence of quantum particle; the motion represents unity of internal and external (i.e. translatory) motions.

(2) The principle of energy of quantum particle: the energy  $E_n \neq 0$ ,  $n = 0, 1, 2, \dots$  (where  $n$  is the energetic quantum number) is inalienable property of a quantum particle. Energy levels  $n$  of the quantum particle arise and disappear only as a result of absorption and emission of other quantum particles, respectively. (Consequently, the problem of quantization of energy is not the Schrödinger problem of eigenvalues).

(3) The principle of equivalence of energy  $E_n$  and frequency  $h\nu_n$  of quantum particle: energy  $E_n$  is related to frequency  $h\nu_n$  by the formula  $E_n \equiv h\nu_n$ ,  $\nu_n \neq 0$  where  $h$ ,  $\nu_n$ , and  $h\nu_n$  are the Planck constant (i.e. quantum of action), the frequency of the periodic process of mutual transformation of the internal and external motions, and frequency of oscillation of the Planck constant, respectively. The concepts of energy  $E_n$  and of frequency  $h\nu_n$  are identical ones. Multiplication of the quantities  $h$  and  $\nu_n$  is permitted by logic law of identity if  $h$  is an oscillating quantity.

(4) The principle of speed of translatory motion of quantum particle: the speed  $v_n$  is defined by the formula  $v_n \equiv \lambda_n \nu_n$  where  $\lambda_n \neq 0$  is the size (the diameter) of the particle. The  $\lambda_n$  equals the distance traveled the particle for the oscillation period  $\tau_n \equiv 1/\nu_n$ . This translatory motion is a result of contraction and extension of the size (diameter) of the particle. Therefore, the translatory motion of the quantum particle relative to a reference system is an absolute one. The

absolute motion is invariant under choice of a reference system. This statement means that the velocity addition theorem for quantum particle is not valid.

(4) The principle of mass and momentum of quantum particle: the mass  $m_n$  and the momentum  $p_n$  are defined by the formula  $E_n \equiv (E_n/v_n^2)v_n^2 \equiv m_n v_n^2 \equiv p_n v_n$ . The concept of mass  $m_n$  and the concept of energy  $E_n$  are not identical ones. Therefore, the formula  $E_n \equiv m_n v_n^2$  does not express the principle of equivalency of mass and energy.

(5) The principle of equivalency of mass and energy of quantum particle: the energy  $E_n$  is related to the mass  $M_n$  by the formula  $E_n \equiv kM_n$  where the concepts of the energy  $E_n$  and the mass  $M_n$  are identical ones,  $k$  is a universal constant,  $[k] = \text{erg}/g$ .

(6) The principle of acceleration and of deceleration of quantum particle: acceleration and deceleration of particle are results of absorption and emission of other quantum particles, respectively. The acceleration  $w_{n+1,n}$  of the quantum particle under the transition  $n \rightarrow (n+1)$  which is due to absorption of other quantum particle (photon) is defined by the formula  $w_{n+1,n} \equiv (v_{n+1} - v_n)(V_{n+1} - V_n) \equiv v_{n+1,n} V_{n+1,n}$ .

These heuristic principles lead to the following explanation of the principle of constancy of light speed. If: (a) light is a set of photons with different energies  $E_n \equiv h\nu_n$ ,  $E'_n \equiv h\nu'_n, \dots$ ; (b) photon cannot absorb other quantum particle and, therefore, the energies of the photons take on values  $E_0 \equiv h\nu_0$ ,  $E'_0 \equiv h\nu'_0, \dots$  only; (c)  $E'_0/E_0 \equiv m'_0/m_0$  (i.e. distinction between energies (frequencies) is distinction between masses), – then the speed of light is the constant to all observers:  $c \equiv v_0 = v'_0 = \text{const}$ .

Thus, the principle of constancy of light speed is immediate consequence of the new quantum theory.

## 6. The Principle of Objectivity of Knowledge & The Theory of the System of Reference

As is known, the principle of relativity (i.e. the second postulate of STR) runs as follows: every physical theory should look the same mathematically to every inertial observer. However, since it refers only to inertial observer, this principle and the concept “inertial frame of reference” are narrow ones for the whole of science. Therefore, they should be replaced by the principle of objectivity of knowledge and a new concept of system of reference based on a new theory of knowledge.

The proposed principle of objectivity of human knowledge and the new concept of system of reference [14] represent the new point of view which has arisen from the critical analysis of the foundations of physics (in particular, the theory of relativity and quantum mechanics), mathematics, cosmology, astrophysics, and philosophy. They are the basis of the new theory knowledge and formulated as follows [14].

(1) Science as the system of the experimental facts and theories is a sphere of the human activity directed to description, explanation, and prediction of the processes and the phenomena of reality. The purpose of scientific activity is to cognize objective laws and truth. Objective law is a form of scientific knowledge of objective reality. (The law is a form of scientific knowledge of the essence (internal, informational aspect) and the phenomenon (external, material aspect). The essence (i.e. information) is the internal aspect of the phenomenon, and the phenomenon (i.e. material objects and processes) is the manifestation of the essence). Truth is an objective content of scientific knowledge. Consequently, the principle of objectivity of human knowledge is formulated as follows: objective laws and truth must be invariant under choice of means and methods of cognition, i.e. under change of properties of system of reference (in particular, objective laws and truth must not contain references to procedure and accuracy of measurement or of calculation).

(2) The system “means of knowledge + Humankind” is called system of reference in the broad sense of the word. It is the part of the complete system “researched objects + means of knowledge + Humankind”. The parts “researched objects” and “system of reference” are mutually independent ones. In this sense, the system of reference is the universal informational and cognizing basis (including natural bodies and processes, the constructed devices and instruments, the sum of human knowledge and skills) formed and used by the Humankind for the purpose of cognition of the world. Since the system of reference is an ordered and universal system, information about the world is an ordered one.

(3) The main cognizing property of the system of reference is that it defines (formulates) the physical laws (i.e. creates theories); the physical laws characterize the system of reference.

(4) The main informational property of the system of reference is that it determines (measures, calculates) the parameters of the subsystem “researched physical object” (for example, it determines the coordinates  $x_M, y_M, z_M$  – geometrical parameters of the physical object **M**) at a moment of time  $t$ ; the parameters characterize the system of reference (for example, the system of coordinates).

(5) The parameters which take on values independently of existence of the researched physical objects represent parameters of the system of reference. For example, the clock **C** – a part of the system of reference – determines (but it does not measure!) the time  $t$ ; the time  $t$  characterizes the clock **C**. If all clocks have been synchronized by men, the universal time  $t$  is a parameter of the system of reference.

(6) Researched physical object **M** and a clock **C** are physically independent (non-connected) objects. Therefore, the coordinates  $x_M, y_M, z_M$  of the object **M** and the time  $t$  are mutually independent parameters. The informational one-to-one correspondence between motion of object **M** and physical clock-process in clock **C** is established by men. For example, it has a form  $x_M = x_M(t), dx_M/dt \equiv v_M$  where  $t$  is an independent variable quantity. Consequently, the concept “space-time” has no scientific meaning.

(7) Mathematical operations on physical quantities are permitted by logic laws if it is assumed that: (a) “researched physical objects + system of reference” is a united, complete system; (b) subsystems “researched physical objects” and “system of reference” are physically independent parts of complete system.

Thus, the proposed principle of objectivity of human knowledge and the new concept of system of reference represent the necessary conditions of existence of science.

## 7. Conclusion

The correct theoretical analysis of the generally accepted foundations of Larmor-Lorentz-Poincare-Einstein’s special theory of relativity (STR) leads to the following main statements.

(1) The foundations of the STR are absolutely incorrect because: (a) the STR contains logical errors. In particular, the basic concept “space-time” is erroneous since the concepts “space” and “time” are mutually independent ones; Einstein’s mass-energy relation contradicts logic law of identity. The existence of logical errors is irrefutable proof of incorrectness of the STR; (b) the STR contradicts Michelson-Morley’s experiments.

(2) The concept “special relativity” should be abolished because a correct STR cannot be constructed in general.

(3) The STR is not consequence of the postulates of the STR.

(4) The first postulate of the STR – the principle of constancy of light speed – is a consequence of the new quantum theory.

(5) The second postulate of the STR – the principle of relativity – is a consequence of the principle of objectivity of human knowledge.

(6) The principle of objectivity of human knowledge is in logical connection with the concept “system of reference”.

(7) The concepts “objectivity of human knowledge” and “system of reference” are basic concepts for science and theory of knowledge. Relation of science to theory of knowledge is that "science without the theory of knowledge becomes primitive and muddled one" (A. Einstein)

And, at last, about "**HOW to BECOME a GOOD THEORETICAL PHYSICIST**" (<http://www.phys.uu.nl/~thoof/theorist.html>). Firstly, secondly, and thirdly, Nobel Laureate in Physics must make a careful study of logic to become a good physicist.

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