ACKNOWLEDGMENT

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Introduction

1. As is known, the study of theoretical physics course plays an important role in modern physicist forming. However, the successful mastery of the course (for example, the world famous "Theoretical Physics Course" by L.D. Landau and E.M. Lifshitz, consisting of nine volumes: 1. Mechanics; 2. Theory of field; 3. Quantum mechanics: Nonrelativistic theory; 4. Relativistic quantum theory; 5. Statistical physics; 6. Hydrodynamics; 7. Theory of elasticity; 8. Electrodynamics of continuum; 9. Physical kinetics) does not mean that a physicist understand, comprehend the foundations of theoretical physics. In order to understand the foundations of physics, physicist should, first, lose faith in scientific authorities, secondly, think independently and, thirdly, work in seclusion for many years. At the same time, attempts to think independently lead inevitably physicist to mastery of philosophical formalism and of formal logic – the only correct methodological basis of critical analysis of science. In order to make these three steps, I, for example, took 30 years.

2. In my opinion, critical situation arises in theoretical physics now. In this connection, Einstein's criticism concerning quantum mechanics can correctly define the state of modern theoretical physics as a whole because modern physics is essentially quantum physics:

– "The more successes are achieved by quantum theory, the more stupid it looks. How people far from physics would laughed if they knew about this state of cause" (1912);

– "The great successes achieved by quantum theory for incomplete quarter of the century from time of its inception can not hide from us the fact that the logical basis of this theory is still missing" (1923);

– "... In finding a common basis for all physics, one must, in my opinion, be careful to base oneself dogmatically upon scheme of the modern theory" (1948);

– "The peculiarity of the present situation in quantum mechanics is, in my opinion, that one calls in questions not the mathematical formalism of the theory but physical interpretation of its statements" (1953);

– "... Despite the fact that I at relatively young age apprehended admiringly de Broglie's a great discovery of internal connection between discrete quantum states and resonance states, nevertheless I made continually attempts to find another way to method of solution of enigma of quanta or at least to promote preparing for such solution. The sense of deep dissatisfaction of the principled

character, which I have from the basis of statistical quantum theory, underlies these attempts" (1953);

– "Perfection of the mathematical formalism of the theory and its considerable success hidden from our view the weight of those sacrifices which have been made for this success" (1953).

The emergence of this new (and, probably, unexpected for many scientists) situation means that there is a problem of truth in theoretical physics. The problem of truth in modern theoretical physics was considered for the first time in the books, "Surprises in theoretical physics" (1979) and "More surprises in theoretical physics" (1991) by famous theoretical physicist Sir Rudolf Peierls. But these books do not contain methodological basis for critical analysis of physics. Unfortunately, they are not handbooks for contemporary physicist. Today only a genius can be possessed of both intuition and courage to cast doubt on generally accepted theories and concepts because a genius goes in his own, independent way. A genius always goes against the stream!

3. As is known, modern theoretical physics consists of the set of theories (for example, physical cosmology, classical mechanics, condensed matter physics, dynamics, dark matter, electromagnetism, field theory, fluid dynamics, special and general relativity, particle physics, quantum mechanics, quantum field theory, quantum electrochemistry, solid state physics, statistical mechanics, thermodynamics) but it 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 of 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 the unity of formal logic and of rational dialectics. And this unity is a science of most general laws of development of the Nature, human society, and correct thinking. Consequently, this system is a methodological basis for a critical analysis of physical theories. The main dialectics principle is the principle of objectivity of human knowledge. It 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 devices, procedure and accuracy of measurement or of calculation). This methodological basis contains general arguments for the deductive proof of the theoretical propositions. The general arguments are represented by the following premises:

(1) Information is essence of the Universe, and material objects (particles, fields, bodies) are manifestation of essence.

(2) The material object has physical properties, and physical properties are the inseparable characteristics of material object and belong only to material object.

(3) Quantitative characteristics of physical properties of material object are called physical quantities. The physical quantity is the measure of material object. The measure is the philosophical category meaning unity of qualitative and quantitative determinacy of material object. The measure means that quantitative determinacy belongs to qualitative determinacy.

(4) Mathematics studies the quantitative determinacy separated from qualitative determinacy of the material (physical) object. Therefore, mathematics has no physical meaning.

(5) Theoretical physics studies the measure of material object, i.e. the unity of qualitative and quantitative determinacy of material object. In this case, the mathematical equation in theoretical physics belongs to physical object (i.e. the mathematical equation contains the reference to physical object) and, consequently, has physical meaning. Mathematical (quantitative) operations on the equation do not lead to change of qualitative determinacy of physical object.

(6) Both quantitative and qualitative determinacy of object obey logic laws. Therefore, according to the logic law of identity, the left and right parts of the mathematical equation must belong to the same physical object (i.e. to the same property of physical object or the physical model of the object). And, according to the logic law of contradiction, the left and right parts of the mathematical equation must not belong to different physical objects (i.e. to different properties, models).

These general arguments (as methodological basis) permit to analyse correctly the foundations of theoretical physics.

For example, this methodological basis is used as follows.

Example 1 (classical mechanics).

From the logic point of view, the problem of the analysis is that to identify a material point M, i.e. to establish the identity relation between concepts "physical object M" and "mathematical object M". The idea of the correct solution of this problem is as follows. As it is known, the material point M is characterized by following quantities: mass m_M; position in system of coordinates at the moment of time t; velocity $\vec{v}_M(t)$; acceleration $d\vec{v}_M/dt$. If mass and velocity are essential (dynamic) properties (signs) of a material point M, then momentum $\vec{p}_M(t) \equiv m_M \vec{v}_M(t)$ represents the dynamic identifier of a material point M. In this case, expressions for kinetic energy $E_M^{(kin)}(t) \equiv p_M^2/m_M = m_M v_M^2(t)$ and for force $\vec{f}_M \equiv d\vec{p}_M/dt$ are consequences of this identifier. It means that $\vec{f}_M \equiv d\vec{p}_M/dt$ is a definition of force. And mass m_M should be determined by other

identifier. Force is a vector manifestation of energy. Thus, the logic approach to the analysis of classical mechanics leads to correct definition of force.

Example 2 (classical electrodynamics).

Analysis of classical electrodynamics within the framework of formal logic results in the following statements:

(a) quantitative (mathematical) relations proposed by Faraday, Maxwell, Lorentz, and others have following qualitative determinacy:

$$(field) = (source\ of\ field);$$

(b) the left-hand and right-hand parts of these quantitative relations must belong to one and only one of the following qualitative determinacy:

$$(field) = (field)\ or\ (source\ of\ field) = (source\ of\ field)$$

expressing the law of the identity of the object;

(c) Faraday's, Maxwell's, and Lorentz's quantitative relations did not belong to the qualitative relations

$$(field) = (field)\ or\ (source\ of\ field) = (source\ of\ field).$$

Consequently, Faraday's, Maxwell's, and Lorentz's relations contradict the logical law of identity. Thus, classical electrodynamics is an erroneous theory, and it should be replaced by a correct theory.

4. 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 mathematical formalism "hide from our view weight of those sacrifices which have been made for this success" (A. Einstein). It is obvious now that the truth is a name of these sacrifices. 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. classical mechanics, classical electrodynamics, thermodynamics, statistical physics and physical kinetics, the special theory of relativity, quantum mechanics) include the set of logical errors [1-45]. These errors are explained by the global cause: the 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 system of concepts. The inductive way of development of physics is characterized, for

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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.* It follows from these words that "the progress in (inductive) science is the underlining of difficulties" (N. Bohr). And non-objective , incorrect theories should be replaced by objective, correct theories.

5. Larmor-Lorentz-Poincare-Einstein's special theory of relativity (STR), Einstein's general theory of relativity (GTR), and quantum mechanics (QM) play particularly important role in modern physics. Necessity of periodic change of basic principles of physics was shown for the first time in these theories. Change of science principles is always accompanied by broadening of scientists' consciousness, and broadened consciousness promotes deductive revision of foundations of science. At the same time, the STR, GTR, and QM brought the paradoxes in theoretical physics. In my opinion, paradoxes are not properties of real phenomena. The paradoxes are consequence the starting-points and bases of the STR, GTR, and QM. Therefore, the paradoxes are the inalienable parts of the STR, GTR, and QM. Today many physicists analyze critically consequences of the foundations of theoretical physics, but only some are aware of instability of the basis of physics. The starting-points and bases of the STR, QM, statistical physics (SP) and physical kinetics (PK), and classical thermodynamics (CT) were logically analyzed for the first time in my original works [1-45].

The purpose of the present work is: to show within the framework of the methodological basis – the unity of formal logic and of rational dialectics – that the generally accepted foundations of the STR, QM, SP, and CT contain logical errors and, consequently, to prove that theoretical physics enters the greatest crisis; to explain that the inductive method of research of the Nature exhausts its potentialities; to develop deductive method of research of the Nature; to show that application of the deductive method leads to formulation of a new science paradigm and of a new theory of knowledge; to propose the theoretical model of God as key to new foundations of science. Or, in comprehensive form, the purpose of the present work is to prove the following theoretical propositions:

(1) The generally accepted foundations of theoretical physics contain essential logical errors. The existence of logical errors is irrefutable proof of incorrectness of the generally accepted foundations. The errors are explained by the global cause: the 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 system of concepts.

(2) Theoretical physics is not essence science but phenomenon science. It means that theoretical physics is an unwieldy science (because it is created by the inductive method); having primitive non-universal foundations; not having a clear purpose; containing a set of delusions, logical errors, and vagueness (vagueness often cannot even be realized and formulated in the generally accepted physical concepts since physics does not contain many universal concepts; furthermore, vagueness often results from the "thoughtless application of mathematics" (L. Boltzmann)). Therefore, physical theories and fields of physics defy both natural unification and correct development. These statements – as a result of my 30-year experience of the critical analysis of foundations of theoretical physics – are the ground for the following main conclusion: physics enters the greatest crisis. The crisis in physics leads to the general crisis in science. Consequently, the inductive method of research of the Nature exhausts its potentialities.

(3) According to M. Planck's opinion, the correct theoretical physics will be created by the rising generation, and opponents of correct physics will gradually die out not having acknowledged their own wrongness. And in accordance with the principle of development of Humankind, the correct physical laws found in the deductive and meditative way will not carry the names of their discoverers.

(4) The problem of scientific truth is the most urgent problem of our time. This problem can be solved only with help of a new theory of knowledge since "science without the theory of knowledge becomes primitive and muddled; … science without religion is lame, religion without science is blind" (A. Einstein).

(5) Application of the deductive method of research of the Nature leads to formulation of a new science paradigm and of a new theory of knowledge. In this connection, the theoretical model of God is a key to new foundations of science.

(6) In accordance with the new theory of knowledge [16, 21, 23–25, 34, 35, 42, 44], science – as "threats and bribery" for Humankind – is a means of cognition. Knowledge of Universe Moral (i.e. universal moral, moral in the broad sense) is aim of scientific activity of Humankind as well as the criterion of truth of science and of human life. Scientific achievements depend on the moral qualities of man: in ancient Greek philosopher Socrates' opinion, the existence of objective truth is consequence of the existence objective moral principles. Therefore, "the moral qualities of the prominent person are, probably, of great importance for the given generation and all course of history than purely intellectual achievements. The lasts depend on greatness of spirit in a greater degree than it is usually accepted to consider" (A. Einstein).

<center>**Chapter 1**</center>

<center>**THE THEORETICAL ANALYSIS**</center>
<center>**OF THE FOUNDATIONS OF QUANTUM MECHANICS**</center>

Abstract. *The critical analysis of the generally accepted foundations of quantum mechanics is proposed. The purpose of the analysis is to prove that the foundations include logical errors. The principle of the unity of formal logic and of rational dialectics is a methodological basis of the analysis. The result is as follows: (a) the generally accepted foundations (i.e., the interpretation of the experimental data on diffraction of quantum particles; the conception of wave-corpuscle dualism; the probabilistic interpretation of the psi-function) are logical errors; (b) the pseudo-informational meaning is the true meaning of the psi-function. Conclusion is that quantum mechanics is not a physical, objective theory but a pseudo-informational one. Therefore, quantum mechanics should be replaced by a physical, objective quantum theory. The new (correct) basis of quantum theory is proposed.*

The purpose of the chapter 1 is to analyze critically the foundations of quantum mechanics and to prove the following theoretical propositions: (a) the generally accepted foundations (i.e., the interpretation of the experimental data on diffraction of quantum particles; the conception of wave-corpuscle dualism; the probabilistic interpretation of the psi-function) are logical errors; (b) the pseudo-informational meaning is the true meaning of the psi-function. The new (correct) foundations of quantum theory are proposed.

1. The Critical Analysis of Experiments on Diffraction of Quantum Particles

The purpose of this section is to prove that the conception of wave-corpuscle dualism contradicts well-known experimental data on diffraction of quantum particles (for example, photons, electrons, neutrons, atoms, molecules). Arguments for the deductive proof are represented by the following premises [19, 20]:

(1) An experimental device for studying diffraction of particles consists of the following basic parts: (a) a source which emits noninteracting monoenergetic particles of the same kind; (b) a scatterer (the scattering target) which scatters particles emitted by the source; (c) a photographic plate which registers emitted particles.

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(2) Any emitted particle is registered as a point on the photographic plate. Some points form an incomplete diffraction picture. The great set of points forms a complete diffraction picture.

(3) The set of the oscillations of a physical quantity is called a wave if these oscillations are the connected oscillations. The set of the oscillations which are the unconnected oscillations is not a wave. An oscillation and a wave are forms of absolute motion.

(4) The essence (qualitative determinacy) of a wave movement of physical quantity is manifested in that the diffraction and interference pictures formed by waves are always complete.

From the premises (1)–(4), the following conclusions are deduced:

(a) The distinction between the complete and incomplete diffraction pictures formed by scattered particles is the quantitative distinction. There is no qualitative distinction since particles always hit in the regions of the diffraction maximums of intensity. It means that the qualitative determinacy of the set of particles is identical to the qualitative determinacy of one particle.

(b) The phenomena of diffraction of a wave and diffraction of a set of quantum particles are not identical. It means that essence (qualitative determinacy) of wave motion of a physical quantity and essence of motion of a particle are not identical. In other words, translatory motion of a particle is not wave movement of a physical quantity.

(c) From comparison of diffraction pictures of a wave and of a set of quantum particles, it follows that qualitative determinacy of wave motion of physical quantity and qualitative determinacy of motion of a set of quantum particles have a common aspect: namely, periodicity of motion, that is, oscillations. Hence, translatory motion of a set of free quantum particles is a set of unconnected oscillations. Therefore, translatory motion of one particle is oscillatory, absolute motion (oscillation).

(d) As it follows from the experimental data, the connectedness or the unconnectedness of oscillations is not the essential feature for formation of a complete diffraction picture. But it is essential feature for formation of an incomplete diffraction picture.

(e) From the phenomenon of interference of a set of quantum particles, it follows that the quantum particle flows around the obstacle and passes through the double-slit. It means that, firstly, the quantum particle is a particle with a varying size and a varying form, and secondly, oscillatory change both of size and form of quantum particle is a way of translatory motion. Therefore, translatory motion is absolute. (These results underlie the new quantum theory [7, 12, 22]).

(f) There are three various forms of matter (namely, a free quantum particle, a field and a body) and, correspondingly, three various forms of translatory motion in nature. Translatory motion of a free quantum particle is oscillatory, absolute motion. Translatory motion of a field is a wave, absolute motion. (A field (for example, the electromagnetic field) is a set of connected quantum

particles (for example, photons)). Translatory motion of a body (i.e. of a classical particle) is relative (nonabsolute) motion.

Thus, the correct theoretical analysis of experimental data on diffraction of quantum particles leads to the conclusion that there is no wave-corpuscle dualism of motion of a quantum particle (i.e. motion of a matter particle is not associated with a matter wave) in nature because the motion of a quantum particle has no wave aspect.

2. The Conception of Wave-Corpuscle Dualism: A Logical Error

The purpose of this section is to prove that de Broglie's hypothesis (associating motion of a quantum particle with a matter wave) and Born's principle (connecting the number of quantum particles with the amplitude of a wave) are logical errors. Arguments for the deductive proof are represented by the following premises [19, 20]:

(1) From the principle of unity of discreteness and of continuity, it follows that models of a structure of material objects is divided into two opposite (nonintersecting) classes: a class of models of discrete structure and a class of models of continuous structure. Opposite classes are boundaries of each other.

(2) The law of identity,

(Model of discrete structure) = (Model of discrete structure)

and   *(Model of continuous structure) = (Model of continuous structure),*

expressing   identity of quality is a formal-logic law.

(3) The law of contradiction,

(Model of discrete structure) ≠ (Model of continuous structure),

expressing contradiction of qualities is a formal-logic law.

(4) Motion is change in general. Periodic change of physical quantity with time is called oscillatory motion (oscillation) of this quantity. If there is oscillation in each point of the object described by model of continuous structure, the set of the mutually connected oscillations is called a wave. And the set of unconnected oscillations is not called a wave. An oscillation and a wave are forms of absolute motion of physical quantity.

(5) Set of noninteracting (free) quantum particles of the same kind (for example, photons, electrons, neutrons, atoms, molecules) is the object which is described by a model of discrete

structure and is not described by a model of continuous structure. From the premises (1)–(5), the following conclusions are deduced:

(a) Set of noninteracting quantum particles has no wave form of motion. Consequently, any quantum particle (as the particular case of the set) has no wave form of motion.

(b) de Broglie's hypothesis (according to which relation between corpuscular and wave aspects of motion of a quantum particle is established by the mathematical equation $E = h\nu$ where E is the energy of the particle, ν is the frequency of the wave, h is the Planck constant) represents incorrect interpretation of the mathematical equation $E = h\nu$. Really, according to de Broglie's interpretation, the left part of the equation belongs to the model of discrete structure, and the right part of the equation belongs to the model of continuous structure. Such an interpretation is a logical error because, according to the law of identity, the left and right parts of the equation must belong to the same model, i.e. E and ν must characterize an individual particle. (According to the new quantum theory [7, 12, 22],

$$E_{(particle)} = h\nu_{(particle)}$$

where $\nu_{(particle)}$ is a frequency of periodic process of mutual transformation of internal and of external (translatory) motion of a quantum particle. Therefore, translatory motion of a free quantum particle represents oscillation of the size and of the form of the particle).

(c) The mathematical (quantitative) relation,

$$I_{(particles)} \neq I_{(wave)}$$

where I is an intensity, follows from the law of contradiction,

(Model of discrete structure)$\neq$ (Model of continuous structure).

Therefore, Born's principle,

$$I_{(particles)} = I_{(wave)} \sim A^2_{(wave)}$$

(where $A_{(wave)}$ is the amplitude of the wave), is a logical error. (In particular, from Born's principle, it follows that motion of one particle is a wave. However, it is refuted by the experimental fact that scattering of a particle does not result in complete diffraction picture). Thus, the conception of wave-corpuscle dualism is a logical error.

3. The Probabilistic Interpretation of the Psi-Function: A Logical Error

As is known, the problem of the interpretation of the ψ-function in quantum mechanics was the subject of the great but uncompleted discussion between Einstein and Bohr. After Einstein and Bohr this problem was not in the centre of physicists' attention. Therefore, now probabilistic interpretation (together with de Broglie's hypothesis) groundlessly underlies the standard formulation of quantum mechanics. In this connection, the purpose of this section is to prove that Born's principle, $P = |\psi|^2$ connecting the probability density P with the ψ-function, is a logical error. Arguments for the deductive proof are represented by the following premises [19, 20]:

(1) According to dialectics, essence and phenomenon are not random aspects of objective reality. When the certain complex of conditions (i.e. the certain complex of external connections and relations) is realized, the phenomenon is divided into a set of events. Events are divided into two opposite (nonintersecting) classes: a class of random events and a class of nonrandom (certain) events. If there is a relation of randomness between elementary events of complete set of events, the relation of randomness defines the concept of the random event. In accordance with this, a class of the variables characterizing events is divided into two opposite (nonintersecting) classes: a class of random quantities and a class of nonrandom (certain) quantities. Opposite classes are boundaries of each other.

(2) Qualitative determinacy of events obeys to the formal-logic laws. The law of identity,

(Random event) = (Random event) and *(Certain event) = (Certain event),*

expressing identity of quality is a formal-logic law. The law of contradiction,

(Random event) ≠ (Certain event),

expressing contradiction of qualities is a formal-logic law.

(3) The concepts of random event, random quantity, probability of random event, and average value of random quantity are basic concepts of the theory of probability.

(4) The statistical ensemble of physical systems defines probability, and probability characterizes the ensemble. The statistical ensemble of physical systems represents an imagined (mental, informational) set of identical physical systems. The probability is the ratio of numbers of the systems of the ensemble. Therefore, the probability is an informational concept, and it has no physical meaning. Only the average of physical quantity has the physical meaning.

(5) The theory of probability studies measure, i.e. unity of qualitative and quantitative determinacy of random events. In this case, the mathematical equation in the theory of probability belongs to the qualitative determinacy of event. Such a mathematical equation has both quantitative and qualitative meaning. Mathematical (quantitative) operations over the equation do not lead to a change of qualitative determinacy of this equation. Both quantitative and qualitative determinacy of the mathematical equation obey to the formal-logic laws. According to the logic law of identity, the left and right parts of the mathematical equation must belong to the same qualitative determinacy. And according to the logic law of contradiction, the left and right parts of the mathematical equation must not belong to different qualitative determinacy.

(6) Formation of the complete diffraction picture in experiments on diffraction of wave is a certain event because there are no incomplete diffraction pictures. In this case, it means that the complete diffraction picture is not the sum of incomplete diffraction pictures.

(7) In experiments on diffraction of the quantum particles, the complete diffraction picture is the sum of incomplete diffraction pictures. In this case, the formation of the incomplete diffraction picture is a random event.

(8) The ψ-function describes a certain event – formation of a complete diffraction picture.

(9) The ψ-function has no physical meaning, i.e. the ψ-function is not a physical quantity.

From premises (1)–(9), the following conclusions are deduced:

(a) The $|\psi|^2$ has neither a probabilistic nor a physical meaning since mathematical (i.e. quantitative) operations do not lead to the birth of probabilistic and physical meaning (qualitative determinacy).

(b) The mathematical (quantitative) expression,

$$P_{(Random\ event)} \neq |\psi_{(Certain\ event)}|^2,$$

is corollary of the formal-logic (qualitative) relation,

$$(Random\ event) \neq (Certain\ event),$$

because the probability of a random event is not a characteristic of a certain event. Thus, the probabilistic interpretation of the ψ-function, i.e. Born's principle

$$P_{(Random\ event)} = |\psi_{(Certain\ event)}|^2,$$

is a logical error. And a correct interpretation the ψ-function should be based on the logic law of identity,

$$(Certain\ event) = (Certain\ event).$$

4. The True Meaning of the Psi-Function

As is known, Einstein could not convince Bohr and other physicists that the concepts "objective reality" and "complete description" represent the key to understanding of true meaning of the ψ-function in quantum mechanics. Einstein's arguments have not been realized. Therefore, the problem of the meaning of the ψ-function has not been solved. In this connection, the purpose of this section is to prove that the pseudo-informational meaning is the true meaning of the ψ-function. Arguments for the deductive proof are represented by the following premises [19, 20]:

(1) Concepts of objective reality and system of reference are key concepts.

(2) The system, 'mankind + means of knowledge', belongs to subjective reality and is called system of reference [14]. In this wide sense, the system of reference is the universal informational and gnostic (cognizing) basis (i.e. the system consisting of natural bodies and processes, the constructed devices and instruments, the sum of human knowledge and skills) created and used by the mankind for the purpose of knowledge of the world.

(3) The main informational property of the unitary system, 'set of physical objects under research + system of reference', is that the 'system of reference' defines (measures, calculates) parameters of the subsystem, 'set of physical objects under research'; parameters characterize the 'system of reference'.

(4) The main gnostic (cognizing) property of the system, 'set of physical objects under research + system of reference', is that the 'system of reference' defines (formulates) the physical laws (i.e. creates theories); the physical laws characterize the 'system of reference'.

(5) Objective physical law is a form of scientific knowledge of objective reality. Opposites (i.e. objective reality and nonobjective (subjective) reality) are boundaries of each other. The principle of objectivity of physical laws is as follows: objective physical laws (i.e. truth) must not contain references to system of reference (in particular, references to procedure and accuracy of measurement or of calculation).

(6) Quantities are divided into two opposite (nonintersecting) classes: a class of physical quantities and a class of nonphysical (informational) quantities. Physical quantities are objective

characteristics of researched material objects. Nonphysical (informational) quantities are not objective characteristics of researched material objects. Nonphysical (informational) quantities are characteristics of a system of reference.

(7) "The peculiarity of the present situation in quantum mechanics is, in my opinion, that one calls in questions not the mathematical formalism of the theory but physical interpretation of its statements" (Einstein, 1953).

(8) The ψ-function has no physical meaning. Hence, the $|\psi|^2$ has no physical meaning because mathematical (i.e. quantitative) operations do not lead to the birth or extermination of physical meaning (i.e. qualitative determinacy).

(9) ψ-function describes certain event. Hence, the $|\psi|^2$ has no probabilistic meaning because mathematical (i.e. quantitative) operations do not lead to the birth or extermination of the probabilistic meaning (i.e. qualitative determinacy).
From premises (1)–(9), the following conclusions expressing true meaning of the ψ-function are deduced:

(a) The ψ-function is not the measure of researched physical object. In other words, the ψ-function (i.e. quantitative determinacy) does not belong to the researched material object (i.e. qualitative determinacy). Therefore, the ψ-function does not represent the complete description of a material object (i.e. of objective reality).

(b) The ψ-function belongs to a system of reference (i.e. subjective reality). The ψ-function is the fictitious informational quantity because, firstly, it does not belong to the researched material object, and secondly, it represents the result of the incorrect analysis of the experimental information. Therefore, the ψ-function is a pseudo-informational quantity.

(c) Probabilistic interpretation of $|\psi|^2$ should be replaced by pseudo-informational interpretation,

$$I_{(pseudo-\inf ormation)} = |\psi_{(pseudo-\inf ormation)}|^2$$

where $I_{(pseudo-\inf ormation)}$ is the pseudo-information intensity. In this case, pseudo-informational average of a physical quantity can be compared with experimental data.

Thus, the generally accepted quantum mechanics is a nonobjective theory (based on unreliable information), a pseudo-theory containing only a partial truth.

5. The New Basis of 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 [7, 12, 13, 19–22]. The basis is formed by the following heuristic principles:

(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

$$E_n \neq 0, \; n = 0, 1, 2, \ldots$$

(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 Shrödinger problem of eigenvalues).

(3) The principle of equivalence of energy E_n and frequency ν_n of quantum particle: energy E_n is related to frequency ν_n by the formula

$$E_n \equiv h\nu_n, \; \nu_n \neq 0$$

where h and ν_n are the Planck constant (i.e. quantum of action) and the frequency of the periodic process of mutual transformation of the internal and external motions, respectively. The concepts of energy E_n and of frequency ν_n are identical ones. Multiplication of the quantities h and ν_n is permitted by logic law of identity if h is an oscillating quantity [41].

(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 λ_n equals the distance traveled by 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

$$E_n \equiv k M_n$$

where the concepts of the energy E_n and the mass M_n are identical ones, k is a universal constant, $[k] = erg/g$.

(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 $n \to (n+1)$ which is due to absorption of other quantum particle (photon) is defined by the formula

$$w_{n+1,n} \equiv (v_{n+1} - v_n)(V_{n+1} - V_n) \equiv v_{n+1,n} V_{n+1,n} .$$

Conclusion

Thus, the foundations of the generally accepted quantum mechanics contain logical errors: the conception of wave-corpuscle dualism; probabilistic interpretation of the psi-function. The true meaning of the psi-function is a pseudo-informational meaning. Therefore, quantum mechanics is a nonphysical, nonobjective, pseudo-informational theory. This theory (i.e. the incomplete description of objective reality) should be replaced by the physical, objective quantum theory (i.e. the complete description of objective reality). The proposed correct foundation of quantum theory furnish the clue to correct description of reality.

Chapter 2

THE THEORETICAL ANALYSIS
OF THE FOUNDATIONS OF THE SPECIAL THEORY OF RELATIVITY

Abstract: *The theoretical analysis of the generally accepted foundations of the special theory of relativity is proposed. The principle of the unity of formal logic and of rational dialectics is a methodological basis of the analysis. The main 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, the concept of space-time, Einstein's formula expressing equivalence of mass and energy) contain logical errors and are not 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.*

The starting-point and basis of the STR were logically analyzed in the original works [1-6, 8, 11, 14, 15, 17, 18, 32, 33, 36, 45]. The purpose of the chapter 2 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.

1. The Logical Analysis of the Special Theory of Relativity

The results of the logical analysis of the STR are as follows.

(1) The assertion 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 underlying cause of this contradiction on the base of the following reasoning.

(a) 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 reference system *E* only in the Sun reference system *S*, and the Sun is a moving reference system *S* only in the Earth reference system *E*. The Michelson-Morley interferometer and an observer (doing measurements and calculations) are in the Earth reference system *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*.

(b) 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.

(2) 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.

(3) The generally accepted opinion is that Lorentz transformation formulae are a consequence of the postulates of the STR. (First Postulate reads as follows: The speed of light in vacuo is the same to all inertial observes. Second Postulate reads as follows: Every physical theory should look the same mathematically to every inertial observer). However, one can prove erroneousness of this opinion if one can prove erroneousness of the standard method of derivation of Lorentz's formulae.

(4) The true sense of the Lorentz transformation formulae becomes apparent if one takes into consideration the following assertions: firstly, the standard method of derivation of Lorentz's formulae is the substitution (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. Therefore, 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 reference system **S** (i.e. the Sun) is given by the expression:

$$x_L = ct, \quad c = const$$

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's calculations as well), t is time.

(b) The material point (for example, Michelson-Morly interferometer's mirror which is in the reference system **E** (i.e. the Earth)) is the object **M**. The Galilean transformation represents the relation between the coordinate x_M of the point **M** in the system **S** and 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) Insertion of the Galilean transformation into the equation of the front of the light beam leads to 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 expresses 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 the relation

$$x_M(t) = x_L(t)$$

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is an equation in the unknown t, then a solution is given by the Michelson-Morly formulae:

$$t = D/(c - V) \quad \text{(in the system } \textbf{\textit{S}}\text{)}$$

and

$$t = D/c \quad \text{(in the system } \textbf{\textit{E}}\text{)}$$

where D is the length of the interferometer's shoulder.

(e) The assertion that equalities $x_M = x_L$ (in the system $\textbf{\textit{S}}$) and $x'_M = x'_L$ (in the system $\textbf{\textit{E}}$) must be valid at any moment of time results in the Lorentz transformations formulae:

$$x_M = \gamma\,(x'_M + \beta x'_L), \quad x_L = \gamma\,(x'_L + \beta x'_M)$$

where

$$x_L = ct, \quad x'_L = ct', \quad \beta \equiv V/c, \quad \text{and} \quad \gamma \equiv (1 - \beta^2)^{-1/2}$$

is the contraction factor. Obviously, this equalities are not consequence of the postulates of the STR.

(f) From the Lorentz transformation formulae, it follows that the equalities

$$x_M = x_L \quad \text{and} \quad x'_M = x'_L$$

are valid at any moment of time. Hence, the physical meaning of the Lorentz formulae is that they express the coincidence of the objects $\textbf{\textit{M}}$ and $\textbf{\textit{L}}$ (which are moved with different speeds) with each other at any moment of time. But such picture of coincidence is physically impossible.

(5) Michelson-Morley's formulae represent conditions that individual light point $\textbf{\textit{L}}$ coincides with interferometer's mirror $\textbf{\textit{M}}$ 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. Obviously, 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** coincides with the mirror **M** at any moment of time. Consequently, the Lorentz transformation formulae represent neither physical nor logical consequence of the postulates of the STR. Moreover, the second logical error results in appearance of a relation between the spatial coordinates and 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, 36]; (c) the essence of space [15, 36].

(7) The third logical error is that the Lorentz transformation formulae include the contraction factor γ. The contraction factor γ transmutes physically independent motions – the motion of the mirror **M** (i.e. 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

$$(1 - \beta) > 0, \quad \beta \equiv V/c < 1,$$

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. 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. 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.

2. The Theory of Time

The new theory of time [4, 11, 36] represents a new viewpoint which has arisen from the critical analysis of the foundations of physics and philosophy. The principal idea leading to the new theory is that the concept of motion furnishes the clue to understanding of the essence of time. The theory is formed by the following assertions:

(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 ν – the number of cycles per the unit duration. The ν 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 unlimited cyclic, uniform, stable (i.e. $v = const$) 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

$$t_i = i\tau, \quad i = 0, 1, 2, ...$$

where $\tau = const$ is the duration of each individual transition, i is the number of individual transitions. The elementary duration τ 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 which was installed on the marked horizontal platform. Day time was defined by the direction and the size of the rod shadow).

These assertions 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 of 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 being 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 representing the informational parameter of the system of reference. Since the elementary duration τ can be chosen as small as desired, one can consider t_i the continuous variable 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 under research + 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.

3. The Theory of Space

The new theory of space [15, 36] represents a new viewpoint that has arisen from the critical analysis of the foundations of physics, mathematics, cosmology, and philosophy. 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:

(a) The principle of the materiality of the Nature. It reads as follows: 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. It reads as follows: an object exists as the objective reality, and motion is a form of existence of object.

(c) The principle of motion of object. It reads as follows: 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. It is defined as follows: the measure is the philosophical category meaning unity of the qualitative and quantitative determinacy of the object.

(e) The category of state. It is defined as follows: 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). It is defined as follows: 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 assertions 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", "set of states", and "space of states" 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 "physical object under research + system of reference" is that the "system of reference" determines (measures, express, calculates) the parameters of the subsystem "physical object under research" (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.

4. The 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, 13, 19, 20, 22]. This basis is formed by the following heuristic principles:

(1) The principle of motion of quantum particle.

(2) The principle of energy of quantum particle.

(3) The principle of equivalence of energy E_n and quantity v_n of quantum particle.

(4) The principle of speed of translatory motion of quantum particle.

(5) The principle of mass and momentum of quantum particle.

(6) The principle of equivalency of mass and energy of quantum particle.

(7) The principle of acceleration and of deceleration of quantum particle.

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

$$E_n \equiv h v_n, \qquad E'_n \equiv h v'_n, \dots;$$

(b) photon cannot absorb other quantum particle and, therefore, the energies of the photons take on values

$$E_0 \equiv h v_0, \qquad E'_0 \equiv h v'_0, \dots \quad \text{only};$$

(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:

$$c \equiv v_o = v'_0 = const.$$

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

5. 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) reads 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, 36] 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, 36]:

(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 "objects under research + means of knowledge + Humankind". The parts "objects under research" 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 "physical object under research" (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 physical objects under research 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) The physical object M under research 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:

$$x_M = x_M(t), \quad dx_M/dt \equiv v_M$$

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) "physical objects under research + system of reference" is a united, complete system;

(b) subsystems "physical objects under research" 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.

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;

(b) Einstein's mass-energy relation contradicts logic law of identity;

(c) the existence of logical errors is irrefutable proof of incorrectness of the STR; (d) 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. The STR is a consequence of coordinate relations $x_M(t) = x_L(t)$ and $x'_M(t') = x'_L(t')$ representing the kinematic condition of coincidence of the objects M (mirror) and L (front of the light beam), which are moved with different speeds, in any moments t and t' of time.

(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 between science and theory of knowledge is that "science without the theory of knowledge becomes primitive and muddled one" (A. Einstein).

Chapter 3

THE THEORETICAL ANALYSIS
OF THE FOUNDATIONS OF STATISTICAL PHYSICS

1. Boltzmann Distribution

Abstract. Modern analysis of the Boltzmann distribution on the basis of probability theory and of Gibbs quantum canonical distribution is proposed. It is shown that the Boltzmann distribution function is neither a reliable result of probability theory nor a consequence of Gibbs quantum canonical distribution. Conclusion is that the Boltzmann distribution function has no statistical and physical meaning, and the concept "Boltzmann distribution" should be abolished.

Introduction

As is known, the Boltzmann distribution function – one of achievements of the 19th century's statistical physics – is widely used in modern physics, for example, in the theory of ideal gas, laser physics, chemical physics, plasma physics. However, this circumstance is neither a criterion of validity nor convincing proof of correctness of the Boltzmann distribution function because a derivation of this function is not based on the concept of random quantity in heat phenomena – probability theory's fundamental concept. Also, in my opinion, the generally accepted statement that the Boltzmann distribution represents the particular case of Gibbs quantum canonical distribution is groundless [39]. To date, no one has cast doubt on the concept "Boltzmann distribution". The purpose of the present section is to analyse this concept on the basis of probability theory and of Gibbs quantum canonical distribution.

1.1. Gibbs Quantum Canonical Distribution

As is known [7, 9, 10, 28, 30, 31, 39, 40], the concept of random quantity is a starting-point for any statistical-physical theory, and the distribution of probabilities gives the correct and complete statistical description of the physical system. If the physical system is a "macroscopic set of free quantum particles", it is called an ideal gas. Ideal gas is called normal (non-quantum) gas if the particles "interact only by the way of mutual collisions" (Einstein). And if the particles of gas do

not interact with each other, the ideal gas is called abnormal (quantum) gas. In the case of heat phenomena in an isolated macroscopic system, "ideal (normal) gas of molecules", molecules collide with each other in a random way. Since the change of energy of a molecule occurs as a result of the great number of random collisions, the energy of the molecule represents a discrete random quantity. If ideal (normal) gas is reduced to the system "molecule + molecular gas" (where "molecule" is a subsystem and "molecular gas" is an surroundings), then the following quantum-statistical assertions are valid [37, 38]:

1) The random quantity takes on the values E_n, $n = 0, 1, 2, \ldots$ where $E_0 = 0$ is origin of counting of the random quantity.

2) Every element E_n of the set of possible values of energy is in unambiguous (one-to-one) correspondence with the probability $f_n(t)$ of the energy state of the molecule. The distribution of probability $f_n(t)$ gives the complete quantum-statistical description of a molecule of gas.

3) Statistical ensemble of identical macroscopic systems, "molecule in n th quantum state + molecular gas" defines the probability $f_n(t)$ that the molecule is in the quantum state n with energy E_n:

$$f_n(t) \equiv \lim_{\mathrm{N} \to \infty} \frac{\mathrm{N}_n(t)}{\mathrm{N}}, \quad \mathrm{N} = \sum_{n=0}^{\infty} \mathrm{N}_n(t), \quad 0 \leq t < \infty,$$

where $\mathrm{N}_n(t)$ is number of macroscopic systems of a "molecule in n th quantum state + molecular gas" in moment of time t; N is the full number of macroscopic systems of "molecule + molecular gas" in the ensemble (this number does not depend on time).

4) Probability $f_n(t)$ characterizes ensemble of systems and satisfies conditions of normalization (and conservation of normalization),

$$\sum_{n=0}^{\infty} f_n(t) = 1, \quad 0 < f_n(t) < 1,$$

of unambiguity and of uniqueness.

5) The statistical-average energy $E(t)$ of the molecule is defined by the relation

$$E(t) \equiv \sum_{n=0}^{\infty} E_n f_n(t).$$

6) A limit of quantity $f_n(t)$ at $t \to \infty$ exists. The limit characterizes the statistical equilibrium state in the macroscopic system "molecule + molecular gas":

$$f_n(\infty) \equiv f_n^{\circ}, \qquad f_n^{\circ} = f_0^{\circ} \exp(-E_n/T)$$

where f_n° is Gibbs quantum canonical distribution, T is statistical temperature of molecule (i.e. the universal statistical parameter of molecules, statistical potential of the system). (It is necessary to make the following remark: the term "Gibbs canonical distribution" is merely historical term because Gibbs cannot define mathematical probability f_n°).

7) Gibbs quantum canonical distribution defines the correct relation between the statistical-average (microscopic) energy E of the molecule, the statistical-average (microscopic) entropy s of the molecule, and the statistical temperature of the molecule. This relation has the form:

$$s = E/T, \qquad E \equiv \sum_{n=0}^{\infty} E_n \, f_n^{\circ}, \qquad s \equiv \sum_{n=0}^{\infty} s_n \, f_n^{\circ}, \qquad s_n \equiv E_n/T = -\ln(f_n^{\circ}/f_0^{\circ}).$$

The following main statements result from the above:

(a) the number $N_n(t)$ of the systems, "molecule in nth quantum state + molecular gas" in ensemble and the full number N of the systems "molecule + molecular gas" in ensemble does not represent the numbers of molecules in the system;

(b) if the energy of the molecule is a random quantity, then distribution function f_n° (Gibbs quantum canonical distribution) does not depend on the number of molecules in the system.

These statements are a basis for discussion of the Boltzmann distribution function.

1.2. Analysis of the Boltzmann Distribution Function

As is known, the Boltzmann distribution function has the following form:

$$b_i = b \, g_i \, Z^{-1} \exp\left(-E_i/T\right)$$

where b is the total density of the molecules; b_i is the density of molecules in state i; T is the temperature; g_i is the degeneracy of state i; and Z is the partition function. From the viewpoint of

probability theory and of Gibbs quantum canonical distribution, the Boltzmann distribution function open to objections. The objections are as follows:

(a) the Boltzmann distribution function is not a consequence of Gibbs quantum canonical distribution. In order to prove this statement, one should assume that the contrary is valid: the Boltzmann distribution function and Gibbs quantum canonical distribution are identical at some conditions , i.e.

$$\exp\left(-E_i/T\right) = b_i\, Z/b\, g_i \equiv f_i^{\circ}/f_0^{\circ} .$$

The identity is reduced to the following form:

$$f_i^{\circ} \equiv f_0^{\circ}\, \frac{b_i}{b}\, \frac{Z}{g_i}, \quad \text{i.e.} \quad f_i^{\circ} \propto \frac{b_i}{b} .$$

This expression means that the probability is defined by the densities of molecules, i.e. the probability f_i° depends on the number of molecules in the system at any conditions. But this result contradicts the correct definition of probability. Consequently, the assumption is not valid. Thus, the Boltzmann distribution function is not a consequence of Gibbs quantum canonical distribution;

(b) the Boltzmann distribution function is not based on probability theory: in the Boltzmann theory of gas, a set of molecules is a statistical ensemble. But such representation contradicts probability theory: from the viewpoint of probability theory, the number of systems, "molecule in i th quantum state + molecular gas" in ensemble represents the number of occurrences of the random event "molecule in i th quantum state + molecular gas". Therefore, probability is a limit of the ratio of two numbers of occurrences. This means that the Boltzmann distribution function is not a reliable result of probability theory.

Conclusion

Thus, modern analysis of the Boltzmann distribution on the basis of probability theory and Gibbs quantum canonical distribution leads to the conclusion that it is open to objections. The main objection is that it is neither a reliable result of probability theory nor the consequence of Gibbs quantum canonical distribution. From this viewpoint, the Boltzmann distribution function has no statistical and physical meaning, and the concept "Boltzmann distribution" should be abolished.

2. The Analysis of Theory of Photon Gas

Abstract. *The new theoretical analysis of the generally accepted foundations of theory of photon (quantum) gas are proposed. The principle of the unity of formal logic and of rational dialectics is the correct methodological basis of the analysis. The new results – the correct quantum-statistical foundations – obtained within the framework of the formulated master equation taking into consideration both the quantum states of the radiating molecule and the quantum states of the photon gas in the isolated macroscopic systems "molecule + molecular gas + monochromatic photon gas" are as follows: (a) Planck's, Einstein's, and Bose's works on the theory of photon (quantum) gas contain logical errors; (b) photon (quantum) gas being born by radiating molecule obeys "Gibbs statistics": equilibrium photon (quantum) gas is described by Gibbs quantum canonical distribution; (c) Planck function ("Bose's distribution") is an consequence of Gibbs quantum canonical distribution; (d) Einstein coefficients (i.e. the coefficients of spontaneous emission, induced emission and absorption) are equal to each other.*

Introduction

As is known, the generally accepted statistical theory of photon (quantum) gas is a result of research of the problem of heat radiation. The foundations of this theory were proposed by M. Planck [46, 47], A. Einstein [48], and S.N. Bose [49] and represent the fundamental part of modern theoretical physics. Up to now, nobody cast doubt on this part of physics since one assumed that the theory of photon gas is in accordance with experimental data. There has been formed the point of view that the works of classics of physics were finally understood and a need for critical analysis these works cannot arise. However, it was recently shown [7, 9, 10, 28, 30, 31, 39, 40] for the first time that the generally accepted foundations of statistical physics contain logical errors. Consequently, there is the problem of truth in Planck's, Einstein's, and Bose's works on theoretical physics, and the critical analysis of the theory of photon gas is the urgent problem of our time. The purpose of the present section is to give critical analysis of Planck's, Einstein's, and Bose's works on the theory of heat radiation and to propose the new (correct) foundations of the statistical theory of photon gas. The obtained results are based on the key idea that the problem of quantum-statistical description of photon gas should be solved within the framework of master equation taking into consideration both the quantum states of the radiating molecule and the quantum states of the photon gas in the isolated macroscopic systems "molecule + molecular gas + monochromatic photon gas". From this point of view, the following connected problems are considered: (a) the theory of equilibrium ideal gas of nonradiating molecules; (b) the theory of non-equilibrium ideal

gas of radiating molecules; (c) the theory of photon (quantum) gas being born by radiating molecule.

2.1. The Critical Analysis of Planck's, Einstein's, and Bose's Theory of Photon Gas

As is known, the generally accepted foundations of the theory of photon gas were proposed by Planck [46, 47], Einstein [48], and Bose [49]. Below, stages of development and the basic representations of this theory are considered.

The first stage is a stage of research of the law of heat radiation. The law of heat radiation was formulated by Planck in work [46, 47]. The derivation of the radiation formula, proposed by Planck, consists of three parts: the classical-electrodynamic calculation, the statistical-thermodynamic approach and the quantum-statistical interpretation.

A starting point of the classical-electrodynamic calculation is "the understanding of the phenomena of emission and of absorption of heat radiation as electromagnetic processes. Emission of heat beams is stipulated by emission of electromagnetic waves from certain elementary oscillators; absorption of heat beams is obliged to resonance phenomenon at which named oscillators not only radiate waves, but also are set in oscillatory motion by waves falling on them" (Planck). The equation of radiation balance between oscillator and radiation represents Planck's formula (i.e. formulation of Planck's radiation law):

$$u_{\nu}^{(radiation)} \, d\nu = \frac{8\pi\nu^2}{c^3} U_{\nu}^{(oscillator)} \, d\nu$$

where ν is the frequency of the resting linear oscillator; $U_{\nu}^{(oscillator)}$ is the energy of the radiating oscillator; $u_{\nu}^{(radiation)}$ is the spectral energy density of radiation; c is the speed of light in vacuo. In order to find $u_{\nu}^{(radiation)}$, it is necessary to define $U_{\nu}^{(oscillator)}$.

The statistical-thermodynamic approach to definition of $U_{\nu}^{(oscillator)}$ is characterized by introduction of two hypotheses. Planck assumed that, firstly, the energy of the resting oscillator is a random quantity. And, secondly, "energy of oscillator must be the whole multiple of element of energy". These hypotheses and the definition

$$\frac{1}{T} = \frac{d\,S^{(oscillator)}}{d\,U_{\nu}^{(oscillator)}} \equiv \frac{1}{E_1} \ln\left(\frac{E_1}{U_{\nu}^{(oscillator)}} + 1\right)$$

of the temperature of the oscillator (where $S^{(oscillator)}$ is the entropy of the oscillator) lead to the following expression:

$$U_\nu^{(oscillator)} = E_1 \left[\exp\left(E_1/T\right) - 1 \right]^{-1}.$$

The quantum-statistical interpretation of quantities $U_\nu^{(oscillator)}$ and E_1 represents the following procedure:

a) an identification of the quantity $U_\nu^{(oscillator)}$ with the statistical-average energy E of the harmonic oscillator, i.e.

$$U_\nu^{(oscillator)} \equiv E, \quad E = \sum_{n=0}^{\infty} E_n f_n^\circ, \quad E_n = E_1 n, \quad f_n^\circ = f_0^\circ \exp\left(-E_n/T\right)$$

where f_n° is Gibbs quantum canonical distribution;

b) an identification of the energy quantum E_1 of the harmonic oscillator with the energy quantum

$$h\nu_1^{(radiation)} \equiv E_{n+1} - E_n$$

of the radiation, i.e.

$$E_1 \equiv h\nu_1^{(radiation)};$$

c) identification of the quantity $\nu_1^{(radiation)}$ with the continuous frequency ν of the electromagnetic radiation, i.e.

$$\nu_1^{(radiation)} \equiv \nu.$$

As a result of such interpretation (i.e. substitution of the energy $h\nu$ of photon into the expression for average energy $U_\nu^{(oscillator)}$ of the oscillator), the oscillator transmutes into non-identical object – photon gas:

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$$U_\nu \equiv h\nu\rho_\nu^\circ, \qquad \rho_\nu^\circ \equiv \left[\exp\left(h\nu/T\right)-1\right]^{-1}$$

where ρ_ν° is Planck function (i.e. the average number of the ν-monochromatic photons being born by the oscillator), T is the temperature of the oscillator. This interpretation is the reason why the expression $U_\nu \equiv h\nu\rho_\nu^\circ$ does not satisfy to the formal-logic law of identity. Really, according to the law of identity, the left and right parts of a mathematical (quantitative) relation must belong to one and the same qualitative determinacy of physical object:

(oscillator) = (oscillator) or *(photon gas) = (photon gas)*

or *(oscillator + photon gas) = (oscillator + photon gas).*

However, the left and right parts of the expression $U_\nu \equiv h\nu\rho_\nu^\circ$ belong to different qualitative determinacy: the left part belongs to the oscillator and the right part belongs to the photon gas. Consequently, this interpretation represents a logical error.

The achievement of the first stage was formulated by Planck as follows: "Measurements confirmed validity of the formula for radiation. However, it has only formal sense of lucky guessed law". "One can give to it its true physical sense if two circumstances will be taken into consideration":

1) "Heat radiation concluded in pure vacuum limited by reflecting walls keeps for ever initial spectral distribution of energy. The fundamental discrepancy between the theory of radiation and the kinetic theory of gases becomes apparent here. The cause of this distinction is that gas molecules collide with each other whereas beams pass through each other. Results of the collisions can be found only with the help of probabilistic laws" (Planck).

2) "Introduction of a minimum quantity of absorbing and of emitting substance leads to gradual change of distribution and its transition into stationary state corresponding black body radiation. Therefore, from the described point of view, calculation of probability of the certain value of energy is impossible in principle without taking into consideration the act of appearance of this energy. And it forces to consider more in detail the processes occurring at emission and absorption of heat radiation" (Planck).

The second stage is characterized by tendency for "giving such form of the theory that it was based upon non-contradictory premises" (Einstein). These premises were formulated by Einstein in work [48]. Einstein considered isolated ideal gas of molecules being in statistical equilibrium with heat radiation. He showed that Planck formula is a consequence of quantum-statistical properties of substance and hypothesis about three processes: spontaneous emission, induced emission and

absorption. He proposed the following form of master equation, expressing a condition of statistical equilibrium in isolated system:

$$\left(A_{nm} + B_{nm}\,\rho^{\circ}\right)f_{m}^{\circ} = B_{mn}\,\rho^{\circ}\,f_{n}^{\circ},$$

where A_{nm}, B_{nm}, B_{mn} are coefficients of spontaneous emission, induced emission and induced absorption, respectively; ρ° and f_{n}° are Planck function and Gibbs quantum canonical distribution, respectively. Einstein coefficients depend only on quantum states of molecule. In order to find the solution in the form of Planck's law, Einstein introduced the following assumptions:

a) Gibbs quantum canonical distribution is valid at $T \to \infty$;

b) coefficients of induced emission and of induced absorption are always equal to each other, i.e.

$$B_{nm} = B_{mn},$$

because they are equal in the case of $T \to \infty$;

c) the ratio of coefficients of spontaneous emission and of induced emission is not equal to one; this ratio expresses Wien displacement law.

The solution of the master equation at these assumptions represents Planck formula. However, Einstein's arguments are open to objections. The main objections are as follows:

(a) Gibbs quantum canonical distribution f_{n}° loses probabilistic meaning at $T \to \infty$ because the set $\sum_{n=0}^{\infty} f_{n}^{\circ}$ is diverged at $T \to \infty$;

(b) the relation $B_{nm} = B_{mn}$ obtained under condition $T \to \infty$ is incorrect;

(c) Einstein formulation of the master equation does not contain any information about the quantum states of the photon gas, i.e. Einstein coefficients do not depend on the quantum states of the photon gas.

Thus, Einstein's work [48] contains logical errors. The main logical error is that coefficients of the master equation does not take into consideration emission and absorption of photons by a molecule.

The third stage is connected with the method of derivation of Planck formula, proposed by Bose [49]. The method is characterized by the peculiarity that the quantum-statistical description of heat radiation is reached without consideration of interaction between radiation and substance: "the

hypothesis of light quanta in a combination with statistical mechanics (in the form in what it has been adapted by Planck for needs of the quantum theory) is sufficient ground for derivation of the law independently of the classical theory" (Bose). Bose's method can be interpreted as follows. One considers the isolated gas of photons putted in volume. The phase space of one photon is divided into s-layers (i.e. "elementary regions of energy" – the monochromatic layers defined by the relationship $\left| E_m - E_n \right|$ where E_m and E_n are values of energy of the molecule emitting and absorbing photons), $0 \leq s < \infty$. And each s-layer is divided into phase space cells – states of photon gas. One postulates that:

(a) existence of phase space cells (states of photon gas) of the layer $\left| E_m - E_n \right|$ does not depend on existence of photon gas;

(b) "empty phase space cell" (i.e. "vacuum state of photon gas") not containing any photon can exist;

(c) energy of monochromatic photon gas is a discrete random quantity;

(d) energy state of photon gas in a cell is characterized by quantum number – number of monochromatic photons (i.e. there is "secondary quantization" of energy of gas);

(e) this quantum number takes values from 0 up to ∞;

(f) the space of permissible states of photon contains the "empty phase space cell".

Quantum-statistical task is to find dependence of probability of state on energy of monochromatic photon gas under condition of conservation of full energy of photon gas.

This task is solved with the help combinatory method and Stirling's formula. The found solution represents Gibbs quantum canonical distribution. As a result of calculation of average energy of the monochromatic photon gas in cell, one obtains Planck function, i.e. "Bose's distribution". Product of average energy of the monochromatic photon gas in cell and number of cells in s-layer gives Planck's formula. Einstein characterized Bose's work as follows: "Bose's derivation is elegant but its essence remains foggy". In my opinion, the essence of this method is foggy because Bose's reasoning contains logical errors. The main logic errors are as follows:

(1) One considers the isolated gas of photons. In this case, energy of monochromatic photon gas cannot be random quantity.

(2) Quantum-statistical description of heat radiation is made without taking into consideration the probability of quantum states of the molecule emitting and absorbing radiation. Therefore, the parameter T of Bose's distribution is treated as temperature of photon gas.

(3) The method is based on concept "empty phase space cell". In accordance with definition, the phase space (set of phase space cells) of physical object (for example, photon) represents set of available (accessible, permissible) states of this object. Since the physical object (photon) cannot be

in unavailable (inaccessible, impermissible) state, this state represents the "empty phase space cell". If the "phase space of one photon" is interpreted as space of elementary events at the quantum-statistical description of photon gas, the concept of probability that photon gas is in the "empty phase space cell" loses sense.

Bose's logical error is that he included "empty phase space cell" (i.e. inaccessible, impermissible state) in space of elementary events (i.e. set of accessible, permissible states). Obviously, such inclusion is equivalent to replacement of the isolated system "photon gas" by the isolated system "molecule + molecular gas + photon gas" since cells (states) of s-layer are born by molecule and are defined by the relation $\left| E_m - E_n \right|$. In this case, the concept of probability that photon gas is in the "empty phase space cell" (i.e. there are no photons in the state $\left| E_m - E_n \right|$) has sense. Owing to it, Bose's logical error was happy: Bose derived Planck formula.

Thus, Planck's, Einstein's, and Bose's reasoning concerning the theory of photon gas are open to objections because these reasoning contain formal-logical errors. Till now, these errors exist in the modern theoretical physics and are manifested in concepts "Bose-Einstein statistics", "Fermi-Dirac statistics", "Dirac physical vacuum", etc. Therefore, elimination of these errors is possible only by the way of construction of the correct statistical theory of photon (quantum) gas. The correct theory should evidently consider interrelation between statistics of photon gas and statistics of radiating molecule of gas. Hence, the purpose of the sections 2.2–2.4 is to propose the correct theory of photon (quantum) gas within the framework of master equations for gas molecule and photon gas. The sections 2.2–2.4 are based on the new (correct) foundations of the theory of quantum particle.

2.2. The Theory of Equilibrium Ideal (Normal) Gas of Nonradiating Molecules

The quantum-statistical theory of isolated macroscopic system – equilibrium ideal (normal) gas of nonradiating molecules – represents the following assertions (premises).

(1) Macroscopic set of free quantum particles is called ideal gas. Ideal gas is called normal (non-quantum) gas if particles "interact only by the way of mutual collisions" (Einstein). Ideal gas is called abnormal (quantum) gas if particles of gas do not interact with each other.

(2) Ideal (normal) gas represents the system "molecule + molecular gas" where "molecule" is a subsystem and "molecular gas" is an surroundings.

(3) A molecule of isolated ideal (normal) gas is individual quantum particle. The energy of the molecule represents discrete random quantity since molecules collide with each other in a random way.

(4) The random quantity takes on the values

$$E_n, \ n = 0, \ 1, \ 2, \ ...$$

where $E_0 = 0$ is origin of counting of the random quantity;

(5) f_n is probability that molecule is in energetic quantum state n and has energy E_n. The probabilities f_n, $n = 0, 1, 2, ...$ give complete quantum-statistical description of the ideal gas of molecules.

(6) Rule of addition of probabilities has the following form:

$$\sum_{n=0}^{\infty} f_n = 1 \quad \text{where} \quad 0 < f_n < 1, \quad \lim_{n \to \infty} (f_{n+1}/f_n) < 1.$$

(7) Rule of combination (multiplication) of probabilities for independent random events has the following form:

$$f_{n,m} = f_n \, f_m$$

where $f_{n,m}$ is combined probability that two molecules have energy $E_n + E_m$. In this case, f_n is the exponential function (A. Cauchy, 1821):

$$f_n = f_0 \exp(-\beta E_n)$$

where $1/\beta$ is a statistical parameter of molecule. The parameter $1/\beta$ is introduced for mathematical reasons: quantity βE_n must be dimensionless one. This parameter is consequence of existence of energy spectrum of quantum particle (atom, molecule) and does not depend on structure of energy spectrum. If the parameter was dependent on n, it would represent value of some (indefinable) random quantity.

(8) The parameter

$$1/\beta = -E_n / \ln (f_n/f_0)$$

or (in other form)

$$1/\beta = -\left(E_{n+1} - E_n\right)\big/ \ln\left(f_{n+1}/f_n\right)$$

represents physical-statistical property of molecules of gas and has both mathematical and physical meaning. From mathematical point of view, $1/\beta$ is a continuous and limited variable. From physical point of view, $1/\beta$ is the physical quantity which has energy dimension. Zero is origin of counting of this physical-statistical quantity and is the same for molecule of any kind. Range of existence of this parameter is defined by the relation

$$0 < 1/\beta < E_\infty \,.$$

Quantum-statistical description of ideal gas of molecules loses statistical meaning outside this range:

    (a) if $1/\beta = 0$, then the energy of the molecule is not a random quantity;

    (b) if $1/\beta = E_\infty$, then the set $\displaystyle\sum_{n=0}^{\infty} f_n$ is diverged.

    (9) The parameter $1/\beta$ has the same value for any (every) molecule of the system. Consequently, $1/\beta$ is the universal statistical parameter (i.e. statistical potential) of the system. This parameter has essential property of temperature. As is empirically known, this property is that temperature has the same value for every part (subsystem) of system if the system is in a state of heat equilibrium. Therefore, the identity

$$1/\beta \equiv T_{(\text{statistical})}$$

is the conjecture, the postulate. Owing to this postulate, the function f_n is called Gibbs quantum canonical distribution, and the temperature $T_{(\text{statistical})}$ is called absolute temperature. The absolute temperature is temperature in the sense of the concept "Gibbs quantum canonical distribution". The existence of the absolute temperature does not depend on the existence of a thermometer (device).

    From the above, it follows that the exponential function

$$f_n = f_0 \exp\left(-E_n \big/ T_{(\text{statistical})}\right)$$

is Gibbs quantum canonical distribution. It has objective meaning because E_n and $T_{(\text{statistical})}$ are independent of existence of a thermometer. It gives complete quantum-statistical description of the equilibrium ideal (normal) gas of molecules.

2.3. The Theory of Non-Equilibrium Ideal (Normal) Gas of Nonradiating Molecules

The quantum-statistical theory of isolated macroscopic system – non-equilibrium ideal (normal) gas of nonradiating molecules – include the theory of equilibrium ideal (normal) gas and represents the following assertions (premises).

1) The theory of equilibrium ideal (normal) gas of nonratiating molecules is valid.

2) A molecule of non-equilibrium ideal (normal) gas is individual quantum particle. Gas represents system "molecule + molecular gas" where "molecule" is a subsystem and "molecular gas" is an surroundings.

3) Molecules collide with each other in a random way. The energy of the molecule represents discrete random quantity since change of energy of a molecule occurs in a random way as a result of the great number of collisions.

4) The random quantity takes on the values E_n, $n = 0,\ 1,\ 2,\ ...$ where $E_0 = 0$ is origin of counting of the random quantity.

5) Every element E_n of the set of possible values of energy is in unambiguous (one-to-one) correspondence with the probability $f_n(t)$ of energetic state of molecule. Distribution of probability $f_n(t)$ gives the complete quantum-statistical description of molecule of gas.

6) Statistical ensemble of identical systems "molecule in n th quantum state + molecular gas" defines probability $f_n(t)$ that the molecule is in the quantum state n with energy E_n:

$$f_n(t) \equiv \lim_{N \to \infty} \frac{N_n(t)}{N}, \quad N = \sum_{n=0}^{\infty} N_n(t), \quad 0 \le t < \infty,$$

where $N_n(t)$ is number of systems "molecule in n th quantum state + molecular gas" in moment of time t; N is full number of systems "molecule + molecular gas" in ensemble (this number does not depend on time).

7) Probability $f_n(t)$ characterizes ensemble of systems and satisfies to conditions of normalization (and conservation of normalization)

$$\sum_{n=0}^{\infty} f_n(t) = 1, \quad 0 < f_n(t) < 1,$$

of unambiguity and of uniqueness.

8) Stochastic process of change of quantum state of molecule represents Markovian process with numerable states. Change of $f_n(t)$ in time t is described by the master equation

$$\frac{d f_n}{d t} = P(f_n), \quad P(f_n) \equiv \sum_{\substack{m=0 \\ m \neq n}}^{\infty} \left[P_{nm}(t) f_m(t) - P_{mn}(t) f_n(t) \right], \quad n = 0, 1, 2, \dots$$

where $P_{nm}(t)$ is rate of transition $m \to n$ (i.e. the probability of transition $m \to n$ per unit time) in the moment of time t. The coefficients $P_{nm}(t)$ and $P_{mn}(t)$ are smooth functions of time t and do not characterize separate (elementary) acts of collisions. These coefficients characterize statistical process of transitions consisting of great number of separate (elementary) acts.

9) There exist limit of quantity $f_n(t)$ at $t \to \infty$. The limit characterizes stationary state. If the state of statistical equilibrium is exists, then the stationary state in the system "molecule + molecular gas" is the state of statistical equilibrium:

$$f_n(\infty) \equiv f_n^{\circ}, \quad f_n^{\circ} = f_0^{\circ} \exp(-E_n/T)$$

where f_n° is Gibbs quantum canonical distribution, T is statistical temperature of molecule.

10) The principle of detailed balance reads as follows: the rates of the processes $m \to n$ and $n \to m$ are equal to each other in statistical equilibrium. The formulation of this principle is as follows:

$$P_{nm}(\infty) f_m^{\circ} = P_{mn}(\infty) f_n^{\circ},$$

i.e. $\quad P_{nm}(\infty) \exp(-E_m/T) = P_{mn}(\infty) \exp(-E_n/T)$

11) The formulation of the principle of detailed balance represents a necessary condition of existence of statistical equilibrium:

$$\frac{P_{nm}(\infty)}{P_{mn}(\infty)} = \exp\left(-\frac{E_n - E_m}{T}\right) \neq 1.$$

This condition means that coefficients $P_{nm}(t)$ и $P_{mn}(t)$ do not obey the principle microscopic reversibility of transition processes.

12) Statistical-average energy $E(t)$ of molecule is defined by the relation

$$E(t) \equiv \sum_{n=0}^{\infty} E_n f_n(t).$$

13) Time $\tau(t)$ of relaxation of energy $E(t)$ is defined by the relation

$$\frac{dE}{dt} = -\frac{E - E^{\circ}}{\tau(t)}.$$

The following assertions result from the above. If the isolated ideal gas tends to statistical equilibrium and reaches statistical equilibrium at $t \to \infty$, then coefficients $P_{nm}(t)$ and $P_{mn}(t)$ of the master equation depend on time and do not obey the principle microscopic reversibility of transition processes. If these coefficients obeyed principle of microscopic reversibility of transition processes, i.e. if

$$P_{nm} = P_{mn},$$

then the stationary state of gas would not be a state of statistical equilibrium.

2.4. The Theory of Photon (Quantum) Gas being Born by Radiating Molecule

The quantum-statistical theory of photon (quantum) gas – isolated macroscopic system "molecule + molecular gas + photon gas" where the subsystem "photon gas" being born by the subsystem "molecule" in the process of quantum transitions not stipulated by acts of collisions – includes the theory of non-equilibrium ideal (normal) gas of nonradiating molecules and represents the following assertions (premises):

1) The theory of non-equilibrium ideal (normal) gas of nonradiating molecules is valid.

2) Process of change of number of photons in the system is stipulated by acts of emission and of absorption of photons by molecules of ideal (normal) gas. This is stochastic process because the process of change of energetic quantum state of the colliding molecule is stochastic process.

3) The statistical ensemble of identical macroscopic systems "molecule in nth quantum state + molecular gas + photon gas" defines probability $f_n(t)$ that molecule is in nth quantum state:

$$f_n(t) \equiv \lim_{N \to \infty} \frac{N_n(t)}{N}, \qquad N = \sum_{n=0}^{\infty} N_n(t), \qquad 0 \le t < \infty,$$

where $N_n(t)$ is number of systems "molecule in nth quantum state + molecular gas + photon gas" in moment of time t; N is full number of systems "molecule + molecular gas + photon gas" in the ensemble (this number does not depend on time).

4) Stochastic process of change of quantum state of molecule of the system "molecule + molecular gas + photon gas" represents Markovian process with numerable states and is described by the master equation

$$\frac{d f_n}{d t} = P(f_n), \ P(f_n) \equiv \sum_{\substack{m=0 \\ m \neq n}}^{\infty} \left[P_{nm}(t) f_m(t) - P_{mn}(t) f_n(t) \right], \ n = 0, 1, 2, \dots \ .$$

5) The set k of identical (i.e. monochromatic) photons being emitted (born) with the energy

$$h \nu_{nm} \equiv \left| E_m - E_n \right|$$

by molecule in the process $m \to n$ ($m > n$) represents ν_{nm}-monochromatic photon gas. The number k of identical photons takes on values from 0 to ∞ since there is no physical prohibition on number of photons being emitted by colliding molecule. (In other words, there exist "secondary quantization" of gas energy).

6) The energy of the monochromatic photon (quantum)) gas is a discrete random quantity. Every value of energy $h \nu_{nm} k$ – element of numerable set $\{ h \nu_{nm} k \}$, $k = 0, 1, 2, \dots$ – is in unambiguous (one-to-one) correspondence with the probability of energetic state of the monochromatic photon gas of system "molecule + molecular gas + ν_{nm}-monochromatic photon gas".

7) The statistical ensemble of identical macroscopic systems "molecule + molecular gas + ν_{nm}-monochromatic photon gas" defines the probability $q_k(\nu_{nm};t)$ that ν_{nm}-monochromatic photon gas is in k th quantum state at moment of time t:

$$q_k(\nu_{nm};t) \equiv \lim_{M(\nu_{nm}) \to \infty} \frac{M_k(\nu_{nm};t)}{M(\nu_{nm})}, \quad \sum_{k=0}^{\infty} q_k(\nu_{nm};t) = 1, \quad M(\nu_{nm}) = \sum_{k=0}^{\infty} M_k(\nu_{nm};t)$$

where $M_k(\nu_{nm};t)$ is number of the systems "molecule + molecular gas + ν_{nm}-monochromatic photon gas in k th quantum state" at moment of time t; $M(\nu_{nm})$ - full number of the systems "molecule + molecular gas + ν_{nm}-monochromatic photon gas" in the ensemble.

In view of these assertions, stochastic process of change of states of ν_{nm}-monochromatic photon gas represents Markovian process with numerable states. It is described by the master equation ($m > n$)

$$\frac{dq_k}{dt} = W_{mn}^{k,k+1} f_n q_{k+1} - \left(W_{nm}^{k+1,k} f_m + W_{mn}^{k-1,k} f_n\right) q_k + W_{nm}^{k,k-1} f_m q_{k-1}$$

where $W_{mn}^{k,k+1}$ is probability of transition $(n,k+1) \to (m,k)$ per unit of time. In accordance with the principle microscopic reversibility of transition processes, the relation

$$W_{mn}^{k,k+1} = W_{nm}^{k+1,k}$$

is valid. The coefficients $W_{mn}^{k,k+1}$ and $W_{nm}^{k+1,k}$ characterize the transition processes $(n,k+1) \leftrightarrow (m,k)$ resulting from a great number of separate (elementary) acts. This master equation at $t \to \infty$ represents the equation of detailed balance

$$f_n^\circ q_{k+1}^\circ = f_m^\circ q_k^\circ, \quad \text{i.e.} \quad q_{k+1}^\circ = q_k^\circ \exp(-h\nu_{nm}/T),$$

where T is the statistical temperature of molecule. Obviously, unique solution q_k° of this functional equation is Gibbs quantum canonical distribution

$$q_k^{\circ} = q_0^{\circ} \exp\left(-h \nu_{nm} k/T\right), \quad q_0^{\circ} = 1 \Big/ \sum_{k=0}^{\infty} \exp\left(-h \nu_{nm} k/T\right) = 1 - \exp\left(-h \nu_{nm}/T\right).$$

This distribution is in accordance with the logic law of identity:

(information on system "molecule + molecular gas + ν_{nm} -monochromatic photon gas") =

(information on system "molecule + molecular gas + ν_{nm} -monochromatic photon gas").

Substituting well-known quantum-mechanical relation

$$W_{mn}^{k,\,k+1} = (k+1) W_{mn}^{01}$$

into the master equation and taking into consideration the definition of statistical-average energy

$$h \nu_{nm} \, \rho(\nu_{nm};t) \equiv h \nu_{nm} \sum_{k=0}^{\infty} k \, q_k(\nu_{nm};t)$$

of ν_{nm} -monochromatic photon gas, one can reduce the master equation to form

$$\frac{d\rho}{dt} = W_{nm}^{10} \left[(\rho+1) f_m - \rho f_n\right]$$

where ρ is statistical-average number of monochromatic photons being born by molecule. In the stationary case (i.e. at $t \to \infty$), this equation takes on the form

$$\left(\rho^{\circ}+1\right) f_m^{\circ} = \rho^{\circ} f_n^{\circ}.$$

The solution of this equation is Planck function (i.e. Bose's distribution):

$$\rho^{\circ} = \left[\exp\left(h \nu_{nm}/T\right) - 1\right]^{-1}.$$

This correct result permits to compare the obtained master equation in the ρ with Einstein's equation. The comparison leads to the unique correct relation for Einstein coefficients:

$$A_{nm} \equiv B_{nm} \equiv B_{mn} \equiv W_{nm}^{10}.$$

Thus, the formulated theory of photon gas is based on statistics of radiating molecule of the normal gas. The equilibrium photon (quantum) gas obeys "Gibbs statistics": photon gas in the isolated equilibrium system "molecule + molecular gas + photon gas" is described by Gibbs quantum canonical distribution. Planck function (Bose's distribution) is consequence of Gibbs distribution. The temperature T in Planck function represents the temperature of radiating molecule of the normal gas. Einstein coefficients A_{nm}, B_{nm}, B_{mn} are equal to each other and, consequently, loss the generally accepted sense.

2.5. Discussion

As is known, the generally accepted science paradigm stipulates an inductive way of knowledge of the world. A scientific truth (as a system of experimental facts and theories) obeys the principle of dialectical development. The dialectical development (i.e., quantitative and qualitative changes in the direction of ascension from simple forms to complicated ones) of the truth includes the "birth and extermination" of some theories, transformation and unification of others. Selection of theories is made on the base of criteria of validity. According to Einstein, there exist two criteria: the "external justification" criterion (i.e. agreement with experimental data) and the "internal perfection" criterion (i.e. accordance with logic laws, with sense of harmony and beauty). "When experience is in accordance with theory, it means "it may be so" for the theory" (Einstein). The theories which do not satisfy these two criteria are obviously incorrect. But they are not unavailing ones: they plays important role in development of knowledge of the world. Incorrect theories and errors are psychological means of broadening of scientists' consciousness, and broadened consciousness promotes deductive revision of foundations of science. In my point of view, the errors are explained by the global cause: the errors are a collateral and inevitable result of inductive method of knowledge of the Nature. One of such erroneous theories of the 20th century is the generally accepted theory of quantum (photon) gas.

If the principle of the unity of formal logic and of rational dialectics is a correct methodological basis of science, then the concept of random quantity must be a starting-point of any physical-statistical theory. In this case, distribution of probabilities gives correct and complete physical-statistical description of the physical system. "The insufficient understanding of this circumstance is a root of those difficulties which one should overcome now" (Einstein). As is known, in the case of

statistical theory of heat phenomena, energy is a random quantity. However, Planck's, Einstein's, Bose's works on the theory photon (quantum) gas and the generally accepted Boltzmann distribution (used by Planck, Einstein, and Bose) are not in accordance with this argument.

Furthermore, Boltzmann, Planck, Einstein, Bose did not understand Maxwell distribution. Even Maxwell did not understand his "Maxwell distribution". But only now one can give correct explanation of Maxwell distribution. Really, from viewpoint of the proposed theory of photon (quantum) gas, correct explanation of Maxwell distribution is as follows [31]:

(1) As is known, an experimental device for studying the Maxwell distribution consists of the following basic physical subsystems:

(a) ideal molecular gas enclosed in a vessel (gas is in the equilibrium state; molecule of gas obeys the Gibbs quantum canonical distribution);

(b) molecule beam which is emitted from the small aperture of the vessel (the small aperture is a stochastic source of quantum particles).

(2) The energy of the molecule of the beam does not represent random quantity, since molecules does not collide with each other. In this case, only the set of the monoenergetic molecules emitted by the stochastic source is a random quantity. This set is called a quantum gas. The probability q_k that the quantum gas has the energy $E_n k$ is given by the Gibbs quantum canonical distribution:

$$q_k = q_0 \exp(-E_n k / T), \quad k = 0, 1, \ldots$$

where k is the number of molecules with energy E_n; T is temperature of the molecule in the vessel.

(3) The average number of the molecules with energy E_n represents the Planck distribution function:

$$\sum_{k=0}^{\infty} k q_k \equiv \rho_{(Planck)}.$$

(4) If

$$E_n \sim m v^2 / 2$$

(where m and v are mass and velocity of molecule, respectively) in classical case, then the expression $E_n \, \rho_{(Planck)}$ represents the Maxwell distribution function:

$$f_{(Maxwell)} \sim E_n \, \rho_{(Planck)} \sim v^2 \exp\left(-mv^2/2T\right).$$

(It is necessary to make the following remark: the term "Maxwell distribution" is merely historical term because Maxwell cannot define mathematical probability q_k).

Consequently, Maxwell distribution function describes only molecule beam. Thus, the critical analysis of the Maxwell distribution shows [31] that the generally accepted statement that the Maxwell distribution function describes gas enclosed in a vessel is a logical error.

Therefore, Planck's, Einstein's, and Bose's arguments concerning to the theory of photon (quantum) gas are open to objection: these arguments contain formal-logical errors. The formal-logical errors in physics could not be realized and comprehended by the classics of physics and by the physicists followed them. As is known from the autobiographies of classics of physics, classics of physics did not sense hard psychological shock when they detected some inconsistencies (obstacles) in physics because they take on trust the possibility of knowing the world. They tried to get round an obstacle and did not try to destroy it. That is why scientific achievements of classics of physics are an effect of long reflection and of momentary-lucid consciousness. The momentary-lucid consciousness cannot propose correct and complete solution of problem. And correct knowledge is effect of both hard psychological shock at detection of inconsistency in science and constantly lucid consciousness. The constantly lucid consciousness promotes comprehension of the following main statements:

(1) the problem of scientific truth is the most urgent problem of our time. This problem can be solved only with help of a new theory of knowledge since "science without the theory of knowledge becomes primitive and muddled" (A. Einstein);

(2) the correct theory of knowledge cannot be built if there is no solution of the problem of existence of God (Creator, Governor) in science;

(3) scientific achievements depend on the moral qualities of man: in ancient Greek philosopher Socrates' opinion, the existence of objective truth is consequence of the existence of objective moral principles. Therefore, "the moral qualities of the prominent person are, probably, of great importance for the given generation and all course of history than purely intellectual achievements. The lasts depend on greatness of spirit to an greater degree than it is usually accepted to consider" (A. Einstein).

Many years later, Bose recollected: "I did not imagine that I did something new. I not so understood statistics to understand how much my approach differed from the approach which Boltzmann could have proposed on the basis of his statistics. Instead of imagining light quanta in the form of particles, I spoke about these states" [50]. Einstein characterized Bose's work as follows: "Bose's derivation is elegant but its essence remains foggy". Bose's idea and method rendered essential influence on Einstein's, Fermi's, and Dirac's works: "The derivation of Planck formula, proposed by Bose, is a great achievement. The method used by him gives also the quantum theory of ideal gas… since light quantum in essence differs from one-atom molecule only in the respect that the rest mass of quantum is vanishing small. The analogy between gas of quanta and gas of molecules should be full" (Einstein). This analogy and "foggy essence of Bose's method" resulted in the erroneous theories of molecular quantum gas, "Bose-Einstein statistics", "Fermi-Dirac statistics", and the erroneous concepts "chemical potential", "secondary quantization", "physical vacuum" [28–40].

Conclusion

Thus, the new theoretical analysis of the generally accepted foundations of theory of photon (quantum) gas leads to the following main statements.

(1) Planck's, Einstein's, and Bose's works on the theory of photon (quantum) gas contain logical errors.

(2) The correct foundations of the statistical theory of photon (quantum) gas are based on the key idea that the problem of correct quantum-statistical description of photon gas must be solved within the framework of master equation taking into consideration both the quantum states of the radiating molecule and the quantum states of the photon gas in the isolated macroscopic systems "molecule + molecular gas + monochromatic photon gas".

(3) The formulated master equation describing photon gas in the isolated macroscopic systems "molecule + molecular gas + monochromatic photon gas" gives the correct and complete quantum-statistical description.

(4) The main results of the quantum-statistical description of photon gas are as follows:

(a) photon (quantum) gas being born by radiating molecule obeys "Gibbs statistics": equilibrium photon (quantum) gas is described by Gibbs quantum canonical distribution; the statistical temperature in Gibbs quantum canonical distribution represents the temperature of the radiating molecule;

(b) Planck function ("Bose's distribution") is a consequence of Gibbs quantum canonical distribution.

(c) Einstein coefficients (i.e. the coefficients of spontaneous emission, induced emission and absorption) are equal to each other.

Chapter 4

THE THEORETICAL ANALYSIS
OF THE FOUNDATIONS OF CLASSICAL THERMODYNAMICS

Abstract. *The correct theoretical analysis of the generally accepted foundations of classical thermodynamics is proposed. The principle of the unity of formal logic and rational dialectics is a methodological basis of the analysis. The result is as follows: the foundations of classical thermodynamics (i.e., the first and second laws, equation of state, concepts of internal energy, of heat energy, of entropy, of temperature) contain logical errors. The existence of logical errors is irrefutable proof of incorrectness of thermodynamics. The correct statistical foundations are proposed.*

Introduction

As is known, thermodynamics is a branch of physics which deals with the heat energy and work of a system. It is a fundamental part of the physical science. The results of thermodynamics are essential for other fields of physics and for chemistry, chemical engineering, cell biology, biomedical engineering, and materials science. The starting point for most thermodynamic considerations are four laws of classical thermodynamics: about internal energy, heat energy, entropy, and temperature. These laws do not depend on the details of the interactions or the systems being studied and postulate that:

(a) energy can be exchanged between physical systems as heat and work;

(b) there exist a quantity named entropy. The main concepts "internal energy", "heat energy", "entropy", and "temperature" are not defined within the framework of thermodynamics.

Therefore, classical thermodynamics – a phenomenological theory – should be scientifically grounded and explained by molecular-kinetic theory and statistical physics. Statistical interpretation of the second and third laws of thermodynamics is an subject of statistical thermodynamics: the statistical interpretation is to derive all macroscopic properties from the statistical properties of moving constituent particles and the interactions between them. The result of great efforts putted into substantiation of the foundations of thermodynamics in 20th century can be expressed by A. Einstein's words: "Classical thermodynamics is the unique classical physical theory which will be never refuted". However, this statement was recently refuted: it was shown [26, 27, 37, 38] for the

first time that the foundations of classical thermodynamics and statistical physics contain logical errors. Consequently, there is the problem of truth in thermodynamics and statistical physics.

From the formal-logical point of view, thermodynamics and statistical physics cannot be compared with each other if there is no logical relations (identity, subordination, collateral subordination, partial coincidence, discrepancy) between thermodynamic and statistical concepts. Therefore, substantiation and explanation of thermodynamics means establishment of logical relations between thermodynamic and quantum-statistical concepts: "General relationship between energy and temperature can be understood only with the help of probabilistic consideration. The problem of temperature connects very closely with quantum hypothesis" (M. Planck). The correct base for comparison of the concepts is Gibbs quantum canonical distribution, and the principle of the unity of formal logic and of rational dialectics represents the methodological basis of the analysis. In accordance with works [26, 27, 37, 38], the critical analysis of the generally accepted foundations of classical thermodynamics (i.e., the first and second laws, equation of state, concepts of internal energy, heat energy, entropy, temperature) is proposed in the chapter 4. The purpose of the analysis is to prove that the standard foundations contain logical (mathematical) errors and to offer the correct formulations.

1. The Correct Formulation of the First Law of Thermodynamics

As is known, the generally accepted first law of thermodynamics reads as follows: the change in the internal energy of a closed thermodynamic system is equal to the sum of the amount of heat energy supplied to the system and the work done on the system. The first law is given by the differential expression

$$dU = dQ + dW$$

where U, Q, W are internal energy, heat energy, and non-heat energy of the system, respectively. But this expression does not take into consideration the empirical fact that there is mutual transformation of heat energy and the work in practice. One should take into consideration this empirical fact in the following way. From mathematical point of view, quantities U, Q, W are in the following relation: U is a function of two independent variables, Q, W. Therefore, the correct formulation of the first law must be based on the concepts of function and differential of function. Really, if internal energy U of system is a function of two independent variables, $Q = Q(t)$

(describing of the heat form of energy) and $W = W(t)$ (describing non-heat form of energy), then the correct formulation of the first law of thermodynamics is

$$\frac{dU(Q,W)}{dt} = \left(\frac{\partial U}{\partial Q}\right)_W \frac{dQ}{dt} + \left(\frac{\partial U}{\partial W}\right)_Q \frac{dW}{dt}$$

where t and $\eta \equiv -\left(\frac{\partial U}{\partial W}\right)_Q \Big/ \left(\frac{\partial U}{\partial Q}\right)_W$ are time and measure of mutual transformation of forms of energy, respectively. (For example, the energy of the molecules which absorbs laser radiation is a non-heat form of energy). Consequently, the generally accepted formulation of the first law of thermodynamics represents a logical (mathematical) error because its content (i.e. special assertion) is not a law (i.e. general assertion).

2. The Correct Formulation of the Second Law of Thermodynamics

As is known, the generally accepted second law of thermodynamics reads as follows: the total entropy of any isolated thermodynamic system tends to increase over time, approaching to a maximum value. The second law is given by the differential expression

$$dS_{(\text{thermodynamic})} = dQ_{(\text{thermodynamic})} \Big/ T_{(\text{thermodynamic})}, \qquad 0 < T_{(\text{thermodynamic})} < \infty$$

where $Q_{(\text{thermodynamic})}$, $S_{(\text{thermodynamic})}$, $T_{(\text{thermodynamic})}$ are the thermodynamic heat energy, the thermodynamic entropy, and the thermodynamic temperature of the system. In order to research this expression, one should establish logical relations between concepts "thermodynamic heat energy", "thermodynamic entropy", "thermodynamic temperature" and concepts "statistical heat energy", "statistical entropy", "statistical temperature". Correct solution of this problem is based on Gibbs quantum canonical distribution which represents the correct and complete quantum-statistical description of isolated macroscopic system – ideal gas of molecules (quantum particles) – in thermodynamic equilibrium.

Gibbs quantum canonical distribution has the form:

$$f_n = f_0 \exp(-E_n / T_{(\text{statistical})}).$$

It has objective meaning because E_n and $T_{(\text{statistical})}$ are independent of existence of a thermometer. Gibbs quantum canonical distribution defines the correct relation between the statistical-average (microscopic) energy E of molecule, the statistical-average (microscopic) entropy s of molecule, and the statistical temperature $T_{(\text{statistical})}$ of molecule. This relation has the form:

$$E = sT_{(\text{statistical})}, \quad 0 < s < 1, \quad \lim_{T_{(\text{statistical})} \to 0} s = 0$$

where

$$E \equiv \sum_{n=0}^{\infty} E_n f_n, \quad s \equiv \sum_{n=0}^{\infty} s_n f_n, \quad s_n \equiv E_n / T_{(\text{statistical})} = -\ln(f_n / f_0).$$

Obviously, the heat energy E is a nonlinear function of the $T_{(\text{statistical})}$ because entropy s depends on the $T_{(\text{statistical})}$. In the case of binary gaseous mixture, it follows from the condition $T_{(\text{statistical})} = T'_{(\text{statistical})}$ of thermal equilibrium that, generally speaking, $E \neq E'$ where E and E' are the statistical-average energies of molecules of components.

The correct relation between microscopic and macroscopic quantities has the form:

$$Q_{(\text{macroscohic})} = S_{(\text{macroscopic})} T_{(\text{statistical})}, \quad Q_{(\textit{macroscopic})} = N_{(\text{macroscopic})} E, \quad S_{(\text{macroscopic})} = N_{(\text{macroscopic})} s,$$

where $N_{(\text{macroscopic})}$ is total (macroscopic) number of molecules in the system. The following statement follows from this relation. If:

(a) the relation

$$Q_{(\text{macroscohic})} = S_{(\text{macroscopic})} T_{(\text{statistical})}$$

is correct;

(b) the identities

$$Q_{(\text{thermodynamic})} \equiv Q_{(\text{macroscopic})}, \quad S_{(\text{thermodynamic})} \equiv S_{(\text{macroscopic})}, \quad T_{(\text{thermodynamic})} \equiv T_{(\text{statistical})}$$

are valid (i.e. thermodynamics concepts "thermodynamic heat energy", "thermodynamic entropy", and "thermodynamic temperature" are identical with the concepts "macroscopic heat energy",

"macroscopic entropy", and "statistical temperature", respectively), – then the generally accepted formulation of the second law of thermodynamics is incorrect. Since the ranges

$$0 < T_{(thermodynamic)} < \infty, \quad 0 < T_{(statistical)} < E_\infty$$

of existence of $T_{(thermodynamic)}$ and $T_{(statistical)}$ differ in degree, there exist partial coincidence between concepts "thermodynamic temperature" and "statistical temperature".

Thus, the generally accepted second law of thermodynamics represents a logical (mathematical) error.

3. The Correct Formulation of the Equation of State

As is known, if movement of molecules (quantum particles) is cause of gas pressure, then average pressure $\bar{p}_{(macroscopic)}$ of molecules of gas is defined by the unique relation

$$\bar{p}_{(macroscopic)} = \bar{\mu}_{(macroscopic)} \bar{E}$$

where $\bar{\mu}_{(macroscopic)}$ and $\bar{E}$ are average number of molecules in unit volume and average energy of one molecule, respectively. This relation represents the correct "equation of state" of gas. In the case of heat movement of molecules, average energy $\bar{E}$ of one molecule is E. Putting

$$E = \bar{p}_{(macroscopic)} / \bar{\mu}_{(macroscopic)}$$

into the left part of the relation

$$Q_{(macroscohic)} = S_{(macroscopic)} T_{(statistical)},$$

one can express "equation of state" in the "heat" form:

$$Q_{(macroscopic)} = \bar{p}_{(macroscopic)} V_{(macroscopic)}, \quad \text{i.e.} \quad S_{(macroscopic)} T_{(statistical)} = \bar{p}_{(macroscopic)} V,$$

where

$$V \equiv V_{(\text{macroscopic})} \equiv N_{(\text{macroscopic})} / \bar{\mu}_{(\text{macroscopic})}, \qquad N_{(\text{macroscopic})} \equiv \bar{\mu}_{(\text{macroscopic})} V$$

are volume of molecular gas and total number of molecules in gas, respectively. If $E_n = E_1 n$ and $E_1/T_{(\text{statistical})} \ll 1$, then value of entropy at the high-temperature limit is approximately equal to one, $s \approx 1$, and heat "equation of state" takes the following linear form:

$$\bar{p}_{(\text{macroscopic})} V \approx N_{(\text{macroscopic})} T_{(\text{statistical})}.$$

Distinction between this form and standard thermodynamic "equation of state",

$$\bar{p}_{(\text{macroscopic})} V = N_{(\text{macroscopic})} T_{(\text{thermodynamic})},$$

is not only distinction in degree, but also distinction in kind. In order to explain qualitative and quantitative determinacy of the $T_{(\text{thermodynamic})}$, one should consider the gas system in development.

As is known, the rational dialectics principle reads as follows: one should consider the system in development. In accordance with this principle, one should consider the following development of the gas system absorbing energy:

(gas of molecules) → *(gas of atoms)* → *(gas of elementary particles).*

The system "gas of elementary particles" does not obey Gibbs quantum canonical distribution. Consequently, the elementary particles (photons, electrons etc.) have no statistical temperature, and the system is not in heat equilibrium. Moreover, the system have no thermodynamic temperature because there is no the heat form of energy in this system. There exist the concept of average energy of elementary particle only: $\bar{E}_{(\text{photon})}$, $\bar{E}_{(\text{electron})}$ etc. . If one measures the average energy with the help thermometer, the thermometer will read the temperature: $T_{(\text{photons})}$, $T_{(\text{electrons})}$ etc. . Temperature (i.e., physical property of the thermometer, the device, contacting the gas) exists only as measure of the thermometer, i.e. as the unity of qualitative and quantitative determinacy of the thermometer, as the ordered set of the thermometer states (thermometer readings). The concept of

temperatures $T_{(\text{photons})}$, $T_{(\text{electrons})}$ is the conventional concept connecting with the existence of the concept of thermometer (device). From formal-logical point of view, it means that the concept of thermodynamic temperature connects inseparably with the concept of thermometer: the concept "thermodynamic temperature" exists as consequence of the concept "thermometer". Consequently, concepts "thermodynamic temperature" and "statistical temperature" are not identical ones, and the concept "thermodynamic temperature" has no objective meaning.

Thus, the expression

$$Q_{(\text{macroscopic})} = \bar{p}_{(\text{macroscopic})} V$$

is the unique correct formulation of the "equation of statistical state". The generally accepted formulation of "equation of thermodynamic state" represents a logical (mathematical) error because, firstly, $T_{(\text{thermodynamic})}$ has no qualitative determinacy at $T_{(\text{thermodynamic})} \to \infty$ and, secondly, the concept of thermodynamic temperature is logically erroneous and non-objective one.

4. Discussion

As is known, formal logic is a science of the laws of correct thinking. One of its main principles is that definition of scientific concept must be exact and complete. However, classical thermodynamics does not satisfy this principle: within the framework of classical thermodynamics – a phenomenological theory, – one cannot give exact and complete definition of the thermodynamic concepts (i.e. concepts of internal energy, of heat energy, of entropy, of temperature). In order to define thermodynamic concepts one should include the concepts of thermodynamic instruments (thermometer, calorimeter etc.) and of measurement in the theory. Theory including concepts of instrument (device) and of measurement is non-objective, and a phenomenological theory excluding these concepts has no scientific meaning. This is the qualitative determinacy of any phenomenological theory. Therefore, the phenomenological, non-objective theory (classical thermodynamics) must be scientifically grounded and interpreted by the objective theory (statistical physics) which has the same object of scientific research. However, a part of results of the phenomenological theory loses scientific meaning at the grounding and interpreting.

Conclusion

Thus, the correct theoretical analysis shows that classical thermodynamics – a phenomenological theory – is not an objective theory. Its foundations (i.e., the first and second

laws, equation of state, concepts of internal energy, of heat energy, of entropy, of temperature) contain logical (mathematical) errors. The existence of logical errors is irrefutable proof of incorrectness of classical thermodynamics. These errors are explained by the global cause: the 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 system of concepts.

Chapter 5

THE THEORETICAL MODEL OF GOD:
KEY TO NEW FOUNDATIONS OF SCIENCE

Abstract. *The chapter 5 is devoted to the 21ˢᵗ century's most urgent problem – the problem of new (correct) foundations of science, i.e. the problem connected with the scientific problem of existence of God. The theoretical proof of the existence and of the uniqueness of God, based on the correct method of knowledge – unity of formal logic and of rational dialectics, – is proposed. This proof represents a theoretical model of God: a system of axioms from which the principle of existence and of uniqueness of God is deduced. The principle runs as follows: God exists as the Absolute, the Creator, the Governor of the essence (information) and of the phenomenon (material manifestation of information). The theoretical model of man and the formulation of the principle of development of Mankind – as consequences of model of God – are proposed as well. The main conclusion is as follows: the principle of the existence and of the uniqueness of God represents absolute scientific truth and, consequently, should be a starting-point and a foundation of the 21ˢᵗ century's correct science.*

> *"Science without religion is lame,*
> *religion without science is blind"*
> (Albert Einstein)

Introduction

1. Lately, the global problem – the problem of stable and safe development – arises in front of Mankind. The analysis of this problem shows that it is inseparably connected with the principle of development and with the global problem of sense and of purpose of existence of Mankind. These problems cannot be solved within the framework of 20ᵗʰ century science – an inductive science. As is known, the 20ᵗʰ century's science paradigm – i.e. the initial conceptual scheme of science, the approach to formulation and solution of problems – is formulated as follows:

(a) God does not exist;

(b) the unity of the world consists in its materiality;

(c) the knowledge of the phenomenon (i.e. the form, the external aspect) determines the knowledge of the essence (i.e. the content, the internal aspect);

(d) any object can be mentally divided into elements; the knowledge of the elements of a system results in knowledge of the system of the elements.

This paradigm stipulates an inductive way of knowledge of the world, formed by ascending movement of knowledge: by the transition of knowledge from lower states into higher states, i.e. by transition from a formulation of separate concepts to the formulation of a system of concepts. An ascending movement of knowledge in the way of an "unlimited" sequence of "dialectic negations" reflects the development of Mankind as ascension from a simple state to a complex state. Inductive science ascertains the fact of development, and researches previous and present states, but does not predict the future (next) states because it does not contain a deductive key to an explanation of the principle of development. In other words, inductive science (unlike a deductive science) does not answer the main question: "Why is there development in the world?" Therefore, the 20th century's science paradigm does not allow us to draw a complete (true) scientific picture of the world and, consequently, to solve correctly the following global problems: the problem of predestination, predetermination (inevitability) of knowledge of the world; the problem of the purpose of knowledge of the world; the problem of the limit of knowledge of the world; the problem of the truth of knowledge of the world; the problem of the existence of the absolute truth; the problem of the sense and purpose of the existence of Mankind; the problem of source and of motive force in the development of Mankind; the problem of the way and of the limit of development of Mankind; the problem of the destination of Mankind; the problem of the essence of the world. Thus, the correct research for the problem of development of Mankind is impossible without formulation of a new paradigm.

2. The formulation of a new paradigm means, first of all, a dialectic negation of 20th century epistemology. As is known, 20th century philosophy is characterized by rigorous scientific methods but it cannot answer the "eternal" questions: "What is man?", "What is life?", "What is death?", "What is the sense and the purpose of a human life?", "Does God (the Creator, the Governor) exist?", "What is God?". The weakness of 20th century epistemology is explained not by a lack of necessary scientific data but by the narrowness of modern scientists' consciousness:

(a) narrow consciousness (which does not contain the concept of God) determines the interpretation of scientific data, and the interpretation of scientific data characterizes narrow consciousness (which does not contain the concept of God);

(b) modern scientists' thinking has not moved far from the well-known interpretation of the key concepts: the categories "reality", "matter", "consciousness", "thinking", "thought", "knowledge", "morals", "truth", and "criterion of truth".

Thus, the dialectic negation of 20th century epistemology and the formulation of a new paradigm are impossible without a broadening of scientists' consciousness, without the critical analysis and correct definition of epistemology's key concepts: the categories "reality", "matter", "consciousness", "thinking", "thought", "knowledge", "morals", "truth", and "criterion of truth".

3. Broadening of scientists' consciousness and the correct definition of scientific concepts (in particular, the categories listed above) are possible only if two different, mutually connected, mutually complementary methods of scientific knowledge of the world are used: the formal-logical method (the method of formal logic) and the rational-dialectical method (the method of rational dialectics). The unity of these methods is not only the correct way of building and of substantiating a system of philosophical knowledge, but also a correct methodological basis for the critical analysis of any system of concepts. Since these methods of scientific knowledge represent the formal-logical and rational-dialectical ways of thinking, scientific knowledge (i.e. the system of scientific concepts) is a consequence of these correct ways of thinking. In other words, the way of thinking determines human knowledge, and human knowledge characterizes a way of thinking. There is no knowledge in general – knowledge separated from and independent of the subject of knowledge – and there is only human and non-human knowledge. Hence, the existence and definition of concepts is the consequence of a way of thinking.

4. Modern scientific thinking is analytical thinking. The purpose of scientific thinking and of scientific knowledge of the world is to comprehend scientific truth. Scientific truth represents the content of objective scientific knowledge, i.e. represents a property of a system of scientific concepts, not depending on the scientists' outlook, and not containing references to the means and methods of knowledge (in particular, to devices, procedure of measurement or calculation). Objective scientific knowledge at a certain moment of history is one of the states of knowledge in the process of inductive knowledge. If the process of inductive knowledge has no upper limit, then knowledge – the system of scientific concepts – is always incomplete. Since the properties of a complete system, generally speaking, qualitatively differ from properties of an incomplete system (i.e. since properties of complete systems are not consequences of properties of incomplete systems), the content of incomplete knowledge represents relative truth. Social practice is an aspect of the criterion of relative truth. In this connection, the problem of the validity of scientific knowledge – one of the central problems in epistemology – cannot be solved without determination of an upper limit of the process of inductive knowledge, without comprehension of absolute truth. In other words, a complete (correct) definition of scientific concepts is impossible if absolute truth does not exist: the absolute truth is the criterion of correctness, of validity of scientific knowledge. Thus, the problem of the existence of an upper limit of inductive knowledge – i.e. the problem of the existence of absolute truth – arises.

5. The statement and solution of the problems of the existence of an upper limit of inductive knowledge, and of the existence of absolute truth, are out of the framework of an inductive science because, according to the definition of the concept "induction", an inductive way of knowledge has no upper limit. Each stage of an inductive way of knowledge provides the statement and solution of a new problem; new scientific knowledge; a result of scientific creativity. As George Polya – the well-known mathematician and pedagogue – has pointed out, the methods of scientific creativity are as follows: a scientist should guess the theorem before he tries to prove it; a scientist should guess the idea of the proof before he will work it out in detail. In this sense, the theorem of the existence of an upper limit of inductive knowledge (the theorem of existence of absolute truth) is my guess, my scientific hypothesis. One can guess this theorem and work out how to try to prove it only if one takes into consideration the concept "God" explained in the main religious sources – the Bible and the Koran. Hence, the problem of development of Mankind represents a logical consequence of the global problem of the existence of an upper limit of inductive knowledge and of the problem of the existence of God. Thus, the scientific solution of the problem of the existence of God (i.e. the correct solution of the problem of the relation between science and religion) is a key to the correct solution of the actual problem of development of Mankind.

6. As is known, one of the main purposes of science and of religion is to explain the world. However, scientific and religious pictures of the world – as results of such explanation – essentially differ from each other. This distinction is not sufficient reason to conclude that science and religion contradict each other. From the formal-logical point of view, science and religion cannot be compared because there are no logical relations (e.g. relations of identity, subordination, collateral subordination, partial coincidence, and discrepancy) between scientific and religious concepts. This is explained by the fact that the structures, principles of knowledge, categories (concepts), and methods of science and of religion are different. For example, science uses an inductive (analytical) method of knowledge. This method is based on the analysis, i.e. mental division, of the object of knowledge into aspects. Religion uses a deductive (non-analytical, meditative) method of knowledge which is not based on analysis. This distinction leads to the conclusion that the main religious concepts – "God", "creation", "result of creation" – and scientific concepts have no general (common) basis and, hence, there is no reason for comparison between them. It means that the problem of the relation between science and religion is a problem of logical-philosophical relations between scientific and religious concepts. It is obvious that this problem cannot be solved within the framework of special sciences (for example, cosmology, astrophysics, physics, biology, genetics) because it is a general scientific problem. In order to compare these concepts, it is necessary to build a scientific model of God. Thus, the problem of the relation between science and religion is reduced to the problem of building a theoretical model of God. Only on the basis of this

model can one establish unambiguous (one-to-one) correspondence between the key scientific and religious concepts.

This leads to the following statement of the problem of stable and of safe development of Mankind [16, 24, 25, 34, 35, 42, 44]:

(a) the solution of the problem of the stable and safe development of Mankind is impossible without knowledge of the principle of development;

(b) the principle of development should be researched within the framework of the new paradigm [16, 21, 23–25, 34, 35, 42, 44] which runs as follows: the world is a unity of essence and phenomenon; the knowledge of essence (i.e. content, internal aspect) of the world determines knowledge of the phenomenon (i.e. forms, external aspect, manifestation of essence); not any object of knowledge can be mentally divided into aspects (elements); the knowledge of elements of a system does not result in knowledge of a system of elements since the properties of a system are not a consequence of the properties of its elements;

(c) the principle of development cannot be correctly formulated without research and solution of the problem of the existence of God, because the principle of development is a logical consequence of the principle of the existence and of uniqueness of God;

(d) the principle of the existence and of uniqueness of God – a starting-point and a basis of the 21st century's correct (deductive) science – should be the logical consequence of a correct scientific knowledge of the interaction between a subject of knowledge and an object of knowledge; this principle should not depend on outlook of any scientist;

(e) it is necessary to build a theoretical model (identifier) of God on the basis of a correct scientific knowledge of the interaction between a subject of knowledge and an object of knowledge (i.e. to build the system of axioms (premises)), and to deduce logically the principle of the existence and of uniqueness of God;

(f) it is necessary to identify God, i.e. to establish an unambiguous (one-to-one) correspondence between the main scientific and religious concepts;

(g) it is necessary to interpret the moral principles, stated in the Bible and the Koran, as criteria of the truth of human life, of human science and of practice, and as the criteria of correct development of Mankind.

In accordance with this statement of the problem, the purpose of the chapter 5 is to propose a scientific approach to a solution of the problem of correct development of Mankind; to propose a starting-point and a foundation for a correct science in 21st century [16, 21, 23–25, 34, 35, 42, 44] – the theoretical model of God and the principle of existence and of uniqueness of God (expressing the content of the theoretical model of God); to propose a theoretical model of man and the principle of the development of Mankind (as the consequences of the model of God). The

constructed model of God represents the theoretical proof of the existence and of uniqueness of God within the framework of a correct methodological basis – the unity of formal logic and of rational dialectics. Therefore, this proof will constitute absolute scientific truth [16, 21, 23–25, 34, 35, 42, 44].

1.   The Correct Methodological Basis of New Foundations of Science

Methodology is a doctrine of the structure, of the logical organization, of methods and of means of activity. Science methodology is a doctrine of principles of building, of forms and of ways of scientific knowledge. The correct methodology of a new foundations of science is based on following propositions:

1.   Two different, interconnected, mutually complementary methods of cognition are used in the process of scientific (analytical) knowledge of the world: the formal-logical method (the formal logic method) and the rational-dialectical method (the rational dialectics method). Formal-logical and rational-dialectic methods of cognition represent the formal-logical and rational-dialectic ways of analytical thinking, useable for achieving the purpose – knowledge of the world. (A method – a way of research – is a way of achieving any purpose, a way of solving a concrete task; a set of modes or operations of the cognition of the object. In philosophy, the method is a way of construction and of substantiation of a system of philosophical knowledge.)

2.   The formal-logical method of cognition is based on the application of formal logic – the science of the laws of correct thinking. A subject (i.e. object of study) of formal logic as science is the law of correct thinking, i.e. the properties of a thought and those conditions the thinking should observe in order to be correct. The content of formal logic as science is expressed by the following four laws which express the most simple and general properties and relations characterizing natural phenomena:

(a) the law of identity;

(b) the law of contradiction;

(c) the law of excluded middle;

(d) the law of sufficient reason.

3.   The rational-dialectic method of knowledge of the world is based on the application of rational dialectics – the rational theory and method of knowledge of the developing world. A subject of rational dialectics as science is the universal laws, which express the universal connections existing in the world. The content of rational dialectics is expressed by the basic laws of dialectics, namely the law of interconnection (unity) of opposites; the law of interconnection of quantitative and qualitative changes; the law of interconnection of negations (i.e. the law of

negation of negation); the theory of systems; the theory of organization; and the theory of control, as well as non-basic laws – dialectics' most important categories (contradiction, measure, quality and quantity, individual and general, cause and effect, necessity and fortuity, possibility and reality, content and form, essence and phenomenon, controlling and controllable). Application of rational dialectics (namely, the law of interconnection (unity) of opposites and the categories of "essence" and "phenomenon") leads to the following fundamental statements [16, 21, 23–25, 34, 35, 42, 44]:

(a) the world represents a unity of opposite aspects: essence (i.e. the internal, non-material aspect, the information aspect having a measure) and phenomenon (i.e. the external, non-information aspect, the material aspect having a measure);

(b) the zero of state (i.e. zero of quantitative determinacy) of the world (i.e. "the beginning of the world") represents a unity of opposites: a unity of zero of the information state (i.e. information zero) and zero of the matter state (i.e. matter zero); the zero of quantitative determinacy does not mean the lack (non-existence) of qualitative determinacy; the zero of quantitative determinacy (i.e. zero of state) exists eternally: it cannot be created or destroyed;

(c) the concepts of "information" and "matter" are the initial concepts designating the aspects of the world;

(d) the problem of the dialectical relation between essence (i.e. the internal aspect as program of existence and of development) and phenomenon (i.e. the external aspect as material manifestation of the program of existence and of development) and the problem of existence and of the uniqueness of the creator of the program are 21st century's philosophy main problems.

It follows from these propositions that: (a) the correct methodological basis of a new foundations of science represents the unity of formal logic and of rational dialectics; (b) the application of a correct methodology to the research of the world leads to a statement of the problem of existence and of the uniqueness of the creator of the world.

2. Definition of the Concepts "Knowledge", "Cognition", and "System of Cognition"

The definition of the concepts "knowledge", "cognition" and "system of cognition" is based on the definition of the concepts "subject of thinking" and "object of thinking":

1.   The concepts "subject" and "object" are defined as follows. "Object" and "subject" are the philosophical categories (concepts) designating two interconnected, interacting aspects (elements) of a system, which are characterized by the essential signs (attributes): "activity" and "passivity". The subject (i.e. set of individuals) is a carrier of the attribute "activity", an active aspect (i.e. an active element of system), a source of the activity directed to a passive aspect (i.e. to a passive element of the system). The object is a carrier of the attribute "passivity", a passive aspect (i.e. a

passive element of the system) to which the activity of the active aspect (i.e. of an active element of system) is directed.

2. The concepts "subject of thinking" and "object of thinking" are defined as follows. The subject of thinking is a subject as a carrier, a source of cogitative activity directed to the object. The object of thinking is an object to which the cogitative activity of the subject is directed. Since the concepts "subject of thinking" and "object of thinking" have sense only in mutual connection, they form a system of concepts. The concepts "subject of thinking " and "object of thinking" offer a basis for the following definitions:

(a) Cognition is an informational interaction between subject and object, which results in knowledge of the object. The object for the cognizant subject is expressed (is reflected, exists) in the form of knowledge. Therefore, the content of science represents expression (reflection, existence) of the given object in the form of knowledge: laws, categories, and other scientific propositions, formed in the process of development of human society. From the logical point of view, the knowledge is a system of concepts and of judgments. From the point of view of the information theory, knowledge is a system consisting of information elements. From the epistemological point of view, the knowledge of the object is the essence of the object of cognition, and the object of cognition is a manifestation of essence.

(b) The process of scientific knowledge of the world is carried out within the framework of the "human systems of cognition" consisting of the "subject of cognition", the set "objects of cognition", "means of cognition", and "knowledge". The category "human system of cognition" is the complete system of concepts determining knowledge, and the knowledge characterizes this system. (Human knowledge is objective if it depends on neither "means of cognition" nor the outlook of the "subject of cognition". Therefore, in the case when it is a question of objective knowledge, one can omit the concepts "means of cognition" and "outlook" for brevity).

3. **Logical Model of the Absolute.**
   The Principle of Existence and of Uniqueness of the Absolute

A logical model of the Absolute is a consequence of formal logic. And the principle of the existence and uniqueness of the Absolute is the content of the logical model of the Absolute. Therefore, this principle is an absolute scientific truth. The logical model of the Absolute represents a system of the following basic axioms (premises) [16, 21, 23–25, 34, 35, 42, 44]:

1. The theorem of the existence of the object is formulated as follows: the object "W" exists if there is information about this object.

2. The theorem of logical completeness is formulated as follows:

(a) if the object "W" exists, then the object "non-W" exists as well;

(b) if the object "non-W" exists, then the object "W" exists as well;

(c) the set of objects "W" and "non-W" is complete. In other words, existence of the object "W" (or "non-W") entails existence of the object "non-W" (or "W"). The object (concept) "non-W" is called logical complement of the object (concept) "W".

3.   In accordance with the theorem of existence of the object, the concrete concept "object of cognition" is divided into two contradicting concepts: concept "object of cognition, divisible into aspects" and concept "object of cognition, indivisible into aspects". The objects making up the volume V of the divisible concept "object of cognition" are divided into two logical classes: the class "objects of cognition, divisible into aspects" and the class "objects of cognition, indivisible into aspects". In other words:

$$V_{(object\ of\ cognition)} = V_{(object\ of\ cognition,\ divisible\ into\ aspects)} + V_{(object\ of\ cognition,\ indivisible\ into\ aspects)},$$

i.e.

(objects of cognition) = (objects of cognition, divisible into aspects)
+ (objects of cognition, indivisible into aspects).

(A logical class is a set of objects having common aspects (essential signs). Owing to the existence of common essential signs, objects are embraced by a general concept.) The basis for such a division is the presence of the sign "divisibility into aspects" in one class and lack of this sign in the other class. Accordingly, the class "objects of cognition, indivisible into aspects" is a non-empty set (i.e. the number of elements of this set is not zero) if the class "objects of cognition, divisible into aspects" is not an empty set.

4.   The volume of the concept "object of cognition, divisible into aspects" contains all objects which are embraced by this concept. Hence, this is a general concept. The volume of this concept is expressed in the form of a logical class – a set of objects which are embraced by this general concept. The class "objects of cognition, divisible into aspects" is the higher class (i.e. it is a genus) relative to other classes of objects and of phenomena, since it includes all other classes of objects and of phenomena. There is no class which can be a genus for it. Therefore, the class "objects of cognition, divisible into aspects" is a higher class in an absolute sense, and the concept "object of cognition, divisible into aspects" is a category. The content of this category is the unique essential sign of objects and of phenomena: divisibility into aspects.

5.   The concept "object of cognition, indivisible into aspects" is a negative concept. The definition of this concept is a negative definition: "object of cognition, indivisible into aspects" is the object indivisible into aspects, not having aspects. This definition (i.e. opening of the content of

concept) is the statement of a lack of essential sign of the object: sign of divisibility into aspects, sign of existence of aspects. In other words, this definition is the negation of the existence of aspects.

6. The volume of the concept "object of cognition indivisible into aspects" is expressed in the form of a logic class – a set of objects which are embraced by this concept. One can prove that the number of objects (elements) in the non-empty set "objects of cognition, indivisible into aspects" cannot be more one. In order to prove it, one should assume that the contrary is valid: the number of objects in this set is two. In accordance with the definition of the logical class, done assumption means that these objects have a common signs (i.e. common aspects) and, consequently, can be embraced by a general concept. But these objects cannot be embraced by a general concept because they have no aspects and, consequently, cannot be compared with each other. If two objects are incomparable with each other, then one of them does not belong to the given set. Hence,

(a) done assumption contradicts the definition of the concept "objects of cognition, indivisible into aspects" , and, consequently, it is incorrect;

(b) the set "objects of cognition, indivisible into aspects" contains only one object;

(c) the concept "object of cognition, indivisible into aspects" is not a general concept, but an individual concept.

This system of axioms (premises) results in absolute truth – the principle of existence and of uniqueness of the Absolute (the object "non-W"). This principle is formulated as follows: (a) the individual concept "object of cognition, indivisible into aspects" ("non-W") exists; this concept represents a category; (b) the category "object of cognition, indivisible into aspects" ("non-W") is designated by the individual logical name "Absolute"; the individual is a bearer of this name; (c) the Absolute does not belong to the set "object of cognition, divisible into aspects" ("W") and exists eternally (i.e. the Absolute cannot be created or destroyed) because the zero state of the world ("W") cannot be created or destroyed.

4. Concrete Definition of Rational Dialectics' Main Principles.
The Dialectic Model of the Creator, of the Governor of Essence and of Phenomenon

A universal connection and relation between objects "Absolute" ("non-W") and "world" ("W") can be defined only by a concrete definition of rational dialectics' main principles. The concrete definition of rational dialectics' main principles represents the system of the following basic axioms (premises) [16, 21, 23–25, 34, 35, 42, 44]:

1. "Reality" is the philosophical (epistemological) category designating the human system of cognition (human system of reference). The categories "reality" and "human system of cognition" are identical concepts.

2. The relation between the volumes of the concepts "reality", "reality divisible into aspects", and "reality indivisible into aspects" is expressed by the following logical form:

$$V_{(reality)} = V_{(reality\ divisible\ into\ aspects)} + V_{(reality\ indivisible\ into\ aspects)}$$

3. The class "reality divisible into aspects" is called the world (object "W"), and the class "reality indivisible into aspects" is called the Absolute (object "non-W"). "Reality divisible into aspects" and "reality indivisible into aspects" are the aspects of reality making up the volume of the concept "reality". Hence, "Absolute" and "world" are the eternal aspects of reality (i.e. these aspects cannot be created or destroyed), forming a complete system "Absolute + world".

4. The world as the "reality divisible into aspects" is the unity of internal and external aspects. The internal aspect is called essence, information. The external aspect is called phenomenon, matter, material manifestation of essence. The essence determines the phenomenon, and the phenomenon characterizes the essence.

5. There is a set of states of information and, consequently, a set of states of matter. Each state of information (information state) determines the state of matter (matter state); the matter state characterizes the information state. Information states are not mutually exclusive, and are manifested as a variety of objects of the world. Manifestation of a zero state of information is a zero state of matter (so-called "physical vacuum" [21]), i.e. an absolute zero state in which matter has no properties (for example, energy, extent).

6. The system "Absolute + world" represents set of the objects (elements) which are in relations and connections with each other, forming the certain integrity, unity.

7. Research of systems is carried out within the framework of the system approach, cybernetics, and the theory of control, which concretely define the main principles of rational dialectics. The concepts "system approach", "cybernetics", and "control" are defined as follows:

(a) The system approach is the methodology of scientific knowledge and of social practice, which is based on consideration of objects as systems. The system approach orientates research toward the disclosing of the integrity of objects, toward the marking of diverse types of connections in objects and towards reducing of them to a uniform theoretical picture.

(b) Cybernetics is a science about the general laws of reception, storage, transfer and processing of information. The principal object of such research is the so-called cybernetic systems considered abstractly, without dependence on their material nature. Examples of cybernetic systems

are a computer, the human brain, biological populations, and human society. Each such system represents a set of interconnected objects (elements of the system) able to perceive, to memorize and to process information, and also to share and interchange information. Modern cybernetics can be divided into a number of sections representing independent scientific directions. The theoretical kernel of cybernetics is the theory of information, the theory of algorithms, the theory of automatic devices, the theory of optimum control, and the theory of recognition of images. Research into cybernetics develops the general principles of the creation of control systems and systems for automation of brainwork.

(c) Control is influencing a system for the purpose of preserving its structure (qualitative specificity), of maintaining it in working condition, of realizing its programs and aims, of perfecting and of developing.

8.   Key concepts in the theory of systems include the system approach (system analysis), cybernetics, the theory of organization, and the theory of control. Key concepts in the theory of control are as follows: "system", "structure", "connection", "hierarchy", "subordination", "creation of system", "synthesis of system", "designing of system", "constructor of system", "operator (governor)", "influence", "controlling influence", "control", "automatic control", "optimum control", "control system", "regulation", "system of regulation", "object", "object of control", "task of control", "purpose of control", "optimization", "program", "movement", "space of states", "motion in space of states", "process", "technological process", "functioning", "functioning of system", "conditions of functioning", "information", "time", "resources (energy, information, computing resources)", "mathematical model", "identification of object (of process)", "reliability", , "informational restrictions", "parameters", "criterion", "criterion of optimization of control", "observability", "identifiability", "controllability", "stability", "stability of process", and "criterion of stability".

9.   The concepts of "observability", "identifiability", and "controllability" are the basis for the statement and solution of problems of the synthesis of systems in the theory of automatic control.

10. The concepts of "observation" and "measurement" are identical concepts. Measurement, observation is a necessary component of control. Measurement is the initial stage of obtaining the necessary information about the controlled object, process. The concepts "control" and "information" are interconnected. Interconnection between control and information obtained by means of measurement and of observation is organic.

11. The concept of controllability is connected with the movement (transition) of a system from one state into another by means of control. This concept has either a structural-qualitative or quantitative sense. In consideration of the structural-qualitative aspect of controllability, the possibility of transition of a controlled system from one set of states into another set is of interest. In

a large system with a hierarchical structure, the controllability of each level (echelon, strata), beginning from the lowest level and finishing with the highest level, can be researched. (Hierarchy is a disposition of the parts or elements of the whole in the decreasing order from the highest to the lowest. The term is used in the general theory of systems for the description of any system objects; in the theory of organization for expression of the principle of control; in sociology for a designation of the social structure of society.) In any case, controllability depends on the structure of the system, the structure of organs of control, the values of the parameters, and the available energy of control.

12. In a broad sense, identification of an object or of process is obtaining or specifying (on the base of experimental data) a model of the given object or process expressed in either terms. In other words, identification (i.e. identification of objects) is the establishment of the correspondence between a recognizable object and the image (model), i.e. the identifier. Identification in a broad sense is an integral part of any true science and has an ancient origin. Identification is carried out (i.e. is expressed) in terms of the chosen class of model. The efficiency of identification in many respects depends on the successfully chosen language of the description and structure of the model, which are entirely based on theoretical aprioristic premises.

13. The concept of stability of movement is one of the basic concepts of the theory of systems and the theory of control because stability is an internal, integral property of system or of movement. This property is described in terms of the space of states. The following proposition is essential. If a system contains a subsystem in a state of unstable equilibrium, and this subsystem is not controlled by the remainder of the system, then the entire system is in the state of unstable equilibrium.

The following statements are deduced from these basic axioms (premises) [16, 21, 23–25, 34, 35, 42, 44]:

(a) If the object is synthesized (constructed, formed, created), then it is mentally divided into aspects. If the object is mentally divided into aspects, then it is synthesized (constructed, formed, created). Consequently, the concepts "object synthesized (constructed, formed, created)" and "object divisible into aspects" are identical ones.

(b) If the object is synthesized (constructed, formed, created), there is a creator (constructor) of the object. From this point of view, if the system "reality = Absolute + world" is a complete system, and the object "world" is mentally divided into aspects, then the object "world" is created by the object "Absolute". The object "Absolute" is not mentally divided into aspects. Hence, the object "Absolute" is not a synthesized (constructed, formed, created) object. The object "Absolute" bears the philosophical name "Creator". The logical category "Absolute" is designated by the individual philosophical name "Creator".

(c) Creation of a set of objects of the world represents the following action. The creator creates and injects the essence (the information, the program) into the information aspect of the world. This essence is manifested in the phenomenon aspect of the world. The manifestation is a set of states of matter. The nonzero state of matter is a set of material objects.

(d) Destruction of the objects of the world represents the following action. The creator destroys the essence (i.e. the information aspect) of material objects. This destruction of the essence is manifested as the destruction of material objects in the phenomenon aspect of the world. Destruction of material objects (for example, in physical, chemical ways) does not mean destruction of their essences (i.e. their information aspect): the essence cannot be destroyed in physical, chemical ways. If the essence of an object cannot be destroyed in physical, chemical ways, then a set of forms of manifestation of this essence exists. Since the essence of a material object is manifested in different forms, destruction of material objects only changes the form of manifestation of the essence, transition (transmutation) of one form (i.e. one set of material properties) into another form (i.e. other set of material properties).

(e) The complete system represents a system having a hierarchical structure: "complete system = controlling system + controllable system". There is a subordination (submission) relation between the "controlling system" and the "controllable system": the "controlling system" is a higher system, and the "controllable system" is a lower system. From this point of view, the system "reality = Absolute + world" is the "complete system", the "Absolute" is the "controlling system" (the controlling, highest aspect of reality), the "world" is the "controllable system" (the controllable, lowest aspect of reality). The logical category "Absolute" is designated by the individual philosophical name "Governor" ("Operator").

(f) Control of the world is carried out as follows: the "Governor" ("Operator") has an informational influence on the world of material objects for the purpose of controlling. This action is manifested as ordering, stabilization, functioning, change, and development of the world. The informational influence upon the object changes the informational content of the object. The change of informational content means a change of the material form (i.e. material properties, for example, energy and mass) of the object. Chaos does not exist. Consequently, the controllable material object represents a complex system: the unity of content (i.e. the informational content of object) and form (i.e. the set of material properties of object).

This system of statements leads to the following conclusion: the logical category "Absolute" is designated by the individual philosophical name "Creator, Governor of essence and phenomenon", i.e. "Creator and Governor of the world".

5. Identification of God

A logical-philosophical definition of the category "Absolute, Creator, Governor of essence and of phenomenon" allows us to identify God, i.e. to solve the problem of unambiguous (one-to-one) correspondence between the main religious and scientific concepts. Comparison of the definition of the religious concept "God" with the definition of the scientific concept "Absolute, Creator, Governor of essence and phenomenon" leads to the statement about the identifiability of the recognizable object "God": there is an unambiguous (one-to-one) correspondence between the religious object "God (Creator, Governor of the world)" and the scientific object "Absolute, Creator, Governor of essence and of phenomenon". This statement can be formulated in the form of the principle of existence and of uniqueness of God: there exists a scientific object "Absolute, Creator, Governor of essence and of phenomenon" which is a unique and correct theoretical model (identifier) of the religious object "God (Creator, Governor of the world)" [16, 21, 23–25, 34, 35, 42, 44].

Thus, from the scientific point of view, God exists as the Absolute, the Creator and the Governor of essence and of phenomenon. The scientific concept "Absolute, Creator, Governor of essence and of phenomenon" is identical to the religious concept "God (Creator, Governor of the world)". This statement is based on formal logic and, consequently, represents absolute scientific truth.

6. Theoretical Model of Man:
A Consequence of the Principle of Existence and Uniqueness of God

The principle of the existence and of uniqueness of God is the basis for following statements [16, 21, 23–25, 34, 35, 42, 44]: Mankind is created by God; the principle of development of Mankind should be considered as a consequence of the principle of the existence and uniqueness of God. From this point of view, the principle of development of Mankind can be formulated only on the base of the theoretical model of man. The theoretical model of man represents a system of following axioms:

(a) Man is a living, self-regulable system of material aspects. This system represents a unity of opposites: the mental aspect (the mental body, i.e. the active, controlling subsystem, "spirit") and the physiological aspect (the human, physiological body, i.e. the passive, controllable subsystem, controllable machine. The machine is so complex that man can never construct it!).

(b) The mental body perceives, memorizes, and processes the information and also transfers (shares, interchanges) the information to its own physiological body and other objects. The brain (as

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a part of complex machine) transforms the information into a form accessible to comprehension and expression. (Hence, study of the structure and of functioning of the physiological body (in particular, of the brain) does not lead to understanding the essential properties of the mental body. For example, it is possible to offer the following analogy. Study of the structure and of function of a car can give only inessential information about the driver: the driver has four extremities and sensory organs).

(c) Destruction (death) of a physiological body – disintegration of the unity of subsystems – does not mean the destruction (death) of a mental body. But the death of a mental body – death in the religious sense of the word – means the death of a physiological body. Hence, the life is the existence of a mental body. And a physiological body is one of the possible forms (i.e. machines) controlled by a mental body.

(d) The mental body is divided into a set of aspects. The main aspects represent a unity of opposites: intellectual sub-aspect ("individual intellect", "mind") and moral sub-aspect ("individual morals", "soul"). These sub-aspects are characterized by a philosophical category – the measure designating the unity of qualitative and quantitative determinacy. Quantitative determinacy of the "individual intellect" and of the "individual morals" are sets of states. Sets of states are characterized with boundaries (intervals) of changes of states: from the lowest value up to the highest value. The lowest and highest values are defined by following concepts: "dark intellect (dark mind)" and "bright intellect (lucid mind)", associated with "individual intellect"; "evil" and "good", associated with "individual morals". These concepts are initial categories. The information about the existence of intellect (mind), of good, and of evil is enclosed in the program of the man. Development of the man is manifested in the transition from the lowest states of the mental body into the highest states.

(e) Illness (i.e. a deviation from the norm) of a mental body (controlling subsystem) leads to illness (i.e. a deviation from the norm) of a physiological body (controllable subsystem). The information about norm boundaries is enclosed in the man program: the boundaries are observed as states of health (normal or abnormal states). A man as a self-regulable system can restore a mental body to a normal state if he knows what the norm (i.e. correct relation between "evil" and "good", boundaries of "evil" and of "good") is.

(f) Intellectual and moral sub-aspects of a mental body are connected in such a way (manner) that the high intellectual state (level) is a necessary condition for comprehension of the moral sub-aspect, and the high moral state (level) is a necessary condition for the achievement of a high intellectual state (level). Disintegration of this connection (i.e. death in religious sense of the word) means that intellectual and moral sub-aspects are absorbed by the different Highest Aspects: in

accordance with selection rules, "soul" is absorbed by the Eden or the Hades, and "bright intellect (lucid mind)" is absorbed by the Supreme Intellect.

(g) A man is the element of the system "Mankind". A man outside the system "Mankind" is an element of another (non-human) system. Properties of system are not the consequence of properties of elements. Properties of a system determine the properties of its elements: the system makes demands of the properties of elements. The properties of the elements characterize the system: a change of properties of the elements leads to a change of the characteristics of the system. Hence, social consciousness determines (controls) individual consciousness.

(h) Mankind is an element of the system "Earth". The Earth as a planet represents the unity of opposites: mental body (active, controlling aspect) and terrestrial body (passive, controllable aspect). The mental body of the Earth controls the development of Mankind. This control is manifested in the form of social and of natural phenomena. Social and natural cataclysms indicate the existence of boundaries of social consciousness. Hence, the mental body of the Earth contains knowledge of Universal Morals and obeys Universal Morals (i.e. morals in the broad sense).

(i) The informational contact between various mental bodies (manifesting, for example, as telepathy, levitation, telekinesis, etc.) is carried out by means of an information channel instead of an energy channel. This contact is carried out without the sending of signals (i.e. material carriers of energy, for example, electromagnetic waves) and, consequently, occurs instantly. The world contains neither material nor informational "emptiness" because the "emptiness" is not the unity of essence and of phenomenon.

Thus, this system of axioms defines a theoretical model of man: man is a living, self-regulable system which is created and controlled by God. The theoretical model of man permits us to formulate the principle of development of Mankind. The principle is formulated as follows. Correct development of Mankind is the movement of social consciousness from the lowest state to the highest state in the way of correct development of each man: namely, the realized movement of individual consciousness ("individual intellect", "individual morals", etc.) from the lowest state to the highest state.

Conclusion

Thus, the formulated principle of the existence and uniqueness of God is the content and logical consequence of the proposed system of scientific axioms. This system of axioms as a theoretical model represents the scientific proof of this principle. This principle is absolute scientific truth: it is truth irrefutable within the frame of science, because it is based on a correct methodological basis – the unity of formal logic and of rational dialectics. This absolute scientific truth is identical to the

religious truth given in the Bibles and the Koran. Hence, the principle of the development of Mankind is a consequence of the existence of absolute scientific truth. According to the Bible and the Koran, Mankind is predestined to serve God. (It is possible to offer the following analogy: if the world is similar to a computer, then God is similar to the programmer and the operator of this computer; the computer and the program are means for the solution of the problems that face the creator of the program and the operator of the computer.)

Since God exists, the main aim of science as a means of cognition is to know Universal Morals (i.e. morals in the broad sense). This fact leads to the statement of a question on the scientific research of the principles of Universal Morals, stated in the Bible and the Koran. As is known, high moral qualities are not a consequence of employment in science. However, scientific achievements depend on moral qualities: for example, in the ancient Greek philosopher Socrates' opinion, the existence of objective truth is a consequence of the existence of objective moral principles. Therefore, "the moral qualities of the prominent person are, probably, of great importance for the given generation and for all course of history than purely intellectual achievements. The lasts depend on the greatness of spirit to greater degree than it is usually accepted to consider" (A. Einstein). In other words, the criterion of truth in science, practice, human life, and the development of Mankind is the principle of Universal Morals.

The system of correct moral principles – the main content of the Bible and the Koran – is a key to understanding the principle of development of Mankind because the development represents an ascension of Mankind on the steps of Universal Morals, and because science and practice are a way and means of the development. The principles of Universal Morals should determine a new paradigm, a methodology of science, interpretation of scientific data, and a scientific picture of the world, and should render essential influence on policy. Comprehension of the principles of Universal Morals, stated in the Bible and the Koran, is the imperative of our time, a necessary condition of the correct (stable and safe) development of Mankind. Hence, the principle of the existence and uniqueness of God should be a starting-point for and a basis of the 21st century's correct science.

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