DIALECTICAL VIEW OF THE WORLD

The Wave Model
(Selected Lectures)

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PREFACE

For more than one hundred years, the Standard Model (SM) dominated for a long time in physics did not move forward humankind to more or less profound understanding the nature and structure of matter – elementary particles and objects composed of them. Accordingly, a real mechanism of many observable physical phenomena involving particles was and is, as before, a big mystery for physicists. Why such a situation has been occurred? From our point of view, fully formed during the long run work, the SM suffers from a primordial deficiency, disability. What do we mean concretely under the last words?

The comprehensive analysis that we have conducted has shown that the principal reason of a resulting disadvantageous situation gradually formed in physics, based during the last century on theories of the SM, is an **erroneous theoretical physics paradigm** lying in the foundation of these theories. The word p**aradigm** can be defined as an intellectual perception or view, accepted by an individual or a society, as a system of basic views, concepts that are used for creating models, or patterns to explain of how things work in the world.

The accepted paradigm dominated in modern physics is based on the formal logic, although it is known that the latter is in essence the logic of limited possibilities. It rests also on numerous abstract and abstract-mathematical postulates – speculative assumptions. The use of abstract (unreal, mythic) postulates, unfortunately, has become a main, routine, method in creation of modern physics theories. Consequently, we must recognize that for these reasons cognition of Nature in the framework of the SM is absolutely impossible. Being guided by common sense, worrying about the future of physics, we must boldly and openly talk about it.

This is why modern physics still does not know answers to such fundamental questions as: what is the charge, what is the origin of mass, what is the nature of gravitation, what is the physical meaning of the speed of light *c* in the mass-energy equation $E_0 = m_0 c^2$, what is the physical meaning of the fine-structure constant α, etc. Modern physics erroneously interprets the meaning of polar-azimuthal functions in Schrodinger's equation, ascribing these functions to atomic "*electron orbitals*". Modern physics is unable to derive theoretically relative atomic

masses of isotopes, magnetic moments of a neutron and a proton, to build a unified field theory, etc.

The listed above is quite sufficient in order to look at the state of theoretical physics by sober eyes and to understand the powerlessness of the Standard Model. We stress again, one of the main reasons of lameness of theoretical physics, as was mentioned above, is very simple, it is the erroneous abstract-mathematical paradigm underlying in its base.

We have come to revealing the aforementioned basic fault of the foundation of physics, due to our long-continued work experience, independent research and teaching physics in different university departments, including the philosophical department. The distressing conclusion to which we unambiguously have arrived turned out to be an extremely serious, although apparently simple, in principle diagnosis of a chronic disease, to put it in medical terms. It must be clearly understandable by everyone who begins to study the subject of the present Lectures.

Just fundamental inability of the Standard Model to comprehend Nature, to solve on its basis the real problems of physics, has led to a situation when the abstract mathematical approach, based on inventing the processes and phenomena non-existent in Nature, was brought to the point of absurdity. In so doing, the main aim of modern physicists-theorists, gradually deviating from the main – the cognition of Nature, has become the competition for the invention of more and more mythical scenarios and events, and virtuosity of their mathematical description.

This is why the most of the scenarios proposed in the last time does not relate to basic fundamental problems of physics (mentioned above). They are devoted mainly on to explaining the phenomena of the cosmic scale, where unlimited room for speculations (fictions) and which cannot be, generally, subjected to a direct experimental verification. The bright example of such a fiction, widely known for all, is a mythic hypothesis about the Big Bang of a “singularity” considering in physics as a phenomenon allegedly happened in the past that gave rise to the birth of the Universe. Another (initial, classical) example from a series of the abstract conceptions (which is unknown for wide public, including many physicists) is an invention of mythic virtual particles that led to the highest degree of absurdity the derivation of the anomalous magnetic moment of an electron in quantum electrodynamics (QED) (see (http://shpenkov.janmax.com/Virtual_Particles.pdf). We will consider this interesting question in detail in one of the Lectures.

Thus, we are aware that the actual situation in theoretical physics is characterized as critical. Therefore, the greatest challenge facing physicists today is to find an exit from a deadlock to which modern physics has come with its numerous unsolved and unsolvable in principle fundamental problems. There is an exceptional need in alternative theories that could take it out of the depression.

We believe that there is the only one truly right exit from this unfavourable state: it is to change completely philosophical basis of theoretical physics. Namely one needs to replace an existing abstract-mathematical paradigm in physics with a new paradigm adequately reflecting reality, and on this new basis to develop truly physical theories in opposition to virtual theories of modern physics.

Unfortunately, not many understand the necessity, or do not want for some reason, to act just in such a cardinal way. We have gone this way and have obtained results, considered in these Lectures, which turned out to be very interesting and impressive, very promising. Last two decades we devoted to an appropriate presentation of the results and, in particular, to the description of a new approach, that we have accepted and developed, making stress on how we revealed on its basis a series of unresolved problems accumulated in physics.

A new physics paradigm that we have accepted and follow in all our works is based on:

(1) Dialectical philosophy and dialectical logic.
(2) The postulate on the *wave nature* of all phenomena and objects in the Universe.

Following the postulate, which is single and real, the wave structure of matter-space is described by well-developed methods of classical wave physics, in particular, by the general wave equation

$$\Delta\hat{\Psi} - \frac{1}{c^2}\frac{\partial^2\hat{\Psi}}{\partial t^2} = 0$$

This equation contains information about both the spherical and cylindrical components of the field of matter-space at all levels of the Universe.

The new physics paradigm, adequate to reality, and solutions of the wave equation led to the dialectical Wave Model (WM) that includes:

1) Dynamic Model (DM) of elementary particles, and
2) Shell-Nodal Model (SNM) of atoms.

Thus, basing on our long experience, we have come to the conclusion that the current theoretical physics paradigm is erroneous and, therefore, must be changed. Accepting the dialectical view on the world, we gradually arrived at the dialectical Wave Model physical in essence, which we regard as an alternative to the abstract-mathematical Standard Model.

The present book of Selected Lectures considers in detail the novel ideas inherent in the WM. Along with a fair criticism of modern theories, for all issues addressed in the Lectures, clear noncontradictory solutions are presented.

All Lectures are based on the present author's works (up to 2002 in co-author with L. Kreidik) appeared in the last two decades mainly in non-conservative physical journals which

accept the well-grounded new ideas laying beyond mainstream theories and devoted to fundamental questions in physics.

I should stress finally that in the literature on physics there is not a constructive analysis of fundamental problems of physics presented in such a manner as it is done in these Lectures. Distinguishing features of the Lectures are the breadth of issues covered by the constructive analysis, its complexity and comprehensiveness. For this reason, the book of Selected Lectures can be useful for all physicists, theorists and experimentalists, specialized in different branches of physics.

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Bielsko-Biała, 2013

Lecture 1

A General Review

Modern technologies are based mostly on a very primitive principle – burning of the mineral raw material such as mineral oil, gas, and coal, and using of radioactive materials. In this connection ecological situation in the World day by day changes for the worse. For this reason humanity rolls gradually up to precipice.

Of course, such a fully formed adverse trend cannot last eternally; one needs to do something in order to change cardinally this situation. Naturally, we must lay our hopes on fundamental sciences, in particular, and first of all, physics. Indeed, physicists by vocation must be directly engaged in this problem. We have the right to wait from them real discoveries of unknown earlier regularities in Nature, which would be applicable for engineering elaborations of new effective sources of energy, environmentally friendly and useful in a wide industrial scale.

However, why do physicists are still so powerless and, especially for the last century, have no substantial advances in the more profound cognition of Nature? Why do, for example, they for a long time and up till now know nothing about the nature of *mass* and *charge* of elementary particles. As a consequence, they do know nothing about the nature of *gravitation* and *gravitational interaction* conditioned by an existence of *mass*, which is an integral property of matter. Accordingly, mankind does not know an answer to the question, what are the fundamental parameters of *gravitational fields* of elementary particles and, hence, all material objects in the Universe consisting of these particles?

From our point of view, the objective reasons of an unsatisfactory and relatively low level of cognition of Nature by modern theoretical physics are the following. Primarily, physics, as the science about fundamental regularities in Nature, makes its first steps on the Earth. It is no wonder; fundamentals of classical mechanics were generalized and formulated by Sir Isaac Newton in 1687. We can regard, conditionally, that year as the year of beginning of contemporary physics; the 325 years have only passed from that time. Hundred years later (1785 - 1789) essential principles of electricity, as the science, were established by Coulomb.

From school times almost everybody knows Newton's laws of motion and universal gravitation and Coulomb's law of interaction between two point charges. What does the period of time in cosmic time scale take up 325 years? In other words, what are the 325 revolutions around the Sun in comparison with the 454×10^7 revolutions during an existence of the Earth (4.54 billion years)? It is less than the twinkling of an eye in cosmic scale.

On the other hand, as it turned out, physicists from the beginning of the 20th century have chosen an erroneous way for their research. It was their fundamental fault; we will explain, why. This way is characterized by creating *abstract* and *abstract-mathematical* models and theories, which, by definition as abstract, have no relation to reality, they do not reflect it. Such a way was/is chosen mainly owing to inability of physicists to finding immediately truly right solutions and due to their desire to describe experimental facts promptly at any cost without hard efforts and spending less time therewith. As a result, cognition of Nature has become entirely impossible. From that time theoretical physics, in fact, makes no headway. Thus, unfortunately, modern physics is not developing in the right direction, gradually degrades, and nowadays, in fact, it turned into the virtual physics.

Really, nothing has changed from Newton's and Coulomb's times in contemporary physics for understanding the nature of such primordial fundamental notions as *mass* and *electric charge*. This holds back the development not only physics but also related sciences, and, consequently, slows down technological progress. At the same time, mass media do not pay attention on the explicit flaws of physics; and, on the contrary, following opinions of the so-called "credible" "leading" physicists, they blow around fictitious "advances" in physics. Quantum mechanics (QM) is a bright example of such an "inflatable bubble".

Remember, at the turning point of centuries the aforesaid scientists, via mass media, have raised the propagandistic noise by announcing QM as the most outstanding theory of physics for the past 20th century. This was made in spite of the fact, very well-known to that time for many, that QM is, actually, the most primitive *abstract-mathematical* theory based on erroneous concepts and characterized by blunders in principle and absurd contradictions [1, 2]. For this reason, in particular, QM is unable to clear out and, hence, explain the origin of *mass* and the nature of electric *charge*. The QM "theory" suffers a series of other shortcomings.

Mass and electric *charge* are primordial fundamental properties of matter (elementary particles). However, up till now contemporary physics is unable to explain what mass is, defining it as the measure of inertia of bodies because of their property to resist changes in the speed, *i.e.*, acceleration. And what is electric charge? Answers to these (and other not mentioned here) questions are impossible to find, in principle, in the framework of the SM.

Why do we speak first of all about these two aforementioned fundamental notions, *mass* and *charge*? The matter is that understanding just their nature is the main clue for understanding other mysteries of Nature directly related to these notions. In particular, as was

said above, knowledge of the nature of mass and charge can clear up a mystery of the phenomenon of *gravitational* interaction of bodies. It is important because with understanding the origin of *gravitation* we will know the ways to influence on gravitation and, hence, to control of it. And as was mentioned above, this will open the doors for the development of ecologically clean power engineering, undoubtedly, realizable on the basis of the knowledge.

Gravitation (or gravity) was the first from the four fundamental interactions, distinguished currently in physics, which became the subject of scientific investigation by man. Perception of gravitation was always indissoluble related with the Earth, and later on it was realized that gravitation acts between all bodies and particles in the Universe. An important peculiarity of gravitation is its *universality*. Every particle in the Universe is a source of the gravitational field by which it interacts with other particles. However, an existence of gravity fields of the particles does not follow from the modern theories of the Standard Model (SM), explicitly indicating thus onto an inconformity of the SM to reality.

We know that gravitational interactions between particles, at least in scale of our galaxy, proceeds in one direction – towards mutual *attraction* of the particles. The amazing feature of the phenomenon of gravitation is its extremely *low intensity* with respect to the perceptible interaction of electrically charged bodies. Gravitational attraction of one individual elementary particle to another one (*e.g*., an electron and a proton) is slightingly low. Gravitational interaction between man and common surrounding macro-objects on the Earth is practically imperceptible.

The well-known classical and modern physics *descriptions* of the phenomena having relation to gravitation are presented in a large amount of textbooks and monographs. We will not consider them because we are interested mainly in the *nature* of gravitation, in internal mechanism of its origin, which is not discussed in official literature on physics due to the lack of at least some sort of acceptable idea.

The nature of gravitation is regarded in modern physics as a highly complex problem. Why? As was said above, the problem is in inability of relevant theories of the SM, as being abstract and abstract-mathematical in essence, to solve the problem in principle. Physicists must realize that we should *comprehend nature* but not only to describe experimental facts, all the more so by inventing nonexistent properties and adjusting them, as it is going on now, in the framework of abstract phenomenological (adjusted) theories. Modern theories of gravitation are the general relativity and a still developing theory of quantum gravitation. For resolution of the gravitation problem it is necessary to turn from a pure abstract (geometrical) theory of gravity, which is the general relativity, dominated currently in physics, to the development of purely physical theories, reflecting as close as possible the real Nature.

Being abstract-mathematical, the SM “does not see” in principle the gravitational field, unquestionable inherent in atoms and their constituents – elementary particles, because it does not know the nature of their mass and electric charge. This means that SM does not know, in general, the true nature and structure of elementary particles. The SM just attempts to describe

behavior of particles; *i.e*., it focuses on answering questions of '*how*'; but it encounters difficulties when questions of '*why*' or '*what*' arise. Therefore the nature of *mass* and *charge* of elementary particles is still one of the unsolved mysteries in physics, just like the relation of bare elementary particles with an ambient field-space, *etc*. To the point, following the as-yet unquestioned modern nuclear atomic model, it is accepted to consider dimensions of elementary particles as not exceeding the size of atomic nuclei. We have arguments to doubt whether this is true; this question will be also discussed in the Lectures.

There are many attempts to construct new theories in order to pull out theoretical physics from a deadlock, in which it turned out to be today. However, the overwhelming majority of efforts in this field are directed mainly on to slight changes of existing theories improving some of their fragments, actually, on to patching holes in old clothes leaving an existent basis of these theories untouched.

Despite not knowing primordial features of matter, physicists, continuing the development of the abstract SM, including an abstract quantum-mechanical model of atoms, are trying to invent the models of more complicated systems such, for example, as the Big Bang model of the origin of the Universe. However, in the course of time, many began to realize that widely-accepted basic concepts of physics are doubtful and they notice that:

> "…*The ideas that were put in place by our intellectual ancestors in the early 1900's are insufficient to deal with the deep issues that are now being explored. The neat and tidy view of the 1970's has given way to confusing collections of paradoxes, puzzles, enigmas, and contradictions*…" [3].

The above comment refers mainly to the problems of elementary particles, gravity, and relativity. Widely recognized as well that the SM

> "*will not be the final theory*" and "*any efforts should be undertaken to finds hints for new physics*" [4].

We see that physicists-theorists very well know lacks of the SM, but, unfortunately, they are unable to replace the model. Knowing that accepted ideas concerning fundamentals of physics are poor, but unknowing better ways, the overwhelming majority of physicists continue their studies in a traditional way, creating more and more complicated abstract theories based on sophisticated mathematics. They continuously seek new ways just for the improvement of the SM.

Thus, official physics prefers a renewal of SM keeping the conceptual basis of the model untouched. In particular, it rests hopes upon String Models of Elementary Particles and their derivatives, membrane models, *etc*. Principal difference of the String Model with respect to the SM is only in the fact that elementary particles in String Models are considered as dimension micro objects – very small strings (less in size than atomic nuclei) – but not as pointlike objects.

The total set of oscillatory modes of the strings must describe, as believed by their creators and adherents, a whole variety of elementary particles and their interactions, including gravitational. A complicated mathematical tool is used with this objective because the strings are 10- and 11-dimensional formations. Unfortunately, String Models, being yet more complicated than the abstract-mathematical SM, do not reflect the real image of elementary particles, tending to describe only their behavior. Physicists-theorists, as for example, David Jonathan Gross, 2004 Nobel Laureate in Physics, recognize the indicated peculiarity and shortcomings of String Models.

A generalized String Model is very far from its final form; if only it will be build completely ever. And what is the most important:

> String Models do not solve the fundamental problem of physics which is the *origin of mass*. Hence, as before, along with the *mass*, the nature of *charges* and *gravitation* will remain to be the great mystery for strings physicists-theorists.

Therefore, the choice of String Models is unsuccessful, rather erroneous; such models have no perspective. Accordingly, we assume that there is no sense to continue efforts and spend time on their further development.

Ignorance of the nature of gravitation and, hence, inability to exert influence upon gravitational parameters of objects by changing intensity of their gravitational fields in value and direction in order to control gravitation does not make possible till now to use a huge energy of gravity for the benefit of mankind.

Thus, the following questions concerning gravitation remain to be open till now, unreciprocated in modern physics:

(1) What is the nature of gravitational fields?

(2) Is possible or not in principle to control gravitational fields of material objects?

We have convincing arguments to state now that we know answers to the above questions. Accordingly, yes, it is possible in principle to control gravitational fields of material objects. Based on what such confidence? The matter is that we, most probably, in the framework of the dialectical approach, considered in these Lectures, found out the solution to the key problems of physics: we got to know the *origin of mass* and the *nature of electric charges*.

As an alternative to the modern abstract-mathematical trend in physics we propose a new in principle approach that we have accepted and use in all our works. It is based on a new philosophical basis, namely, on dialectics (dialectical philosophy and dialectical logic) and only one postulate – real and unquestioned – the postulate on the wave nature of all objects and phenomena in Nature. The philosophical basis that we propose is opposed to that one based on the formal logic and numerous abstract postulates laying in the foundation of modern physics. Just the new approach led us to uncovering the *nature of mass* and *charges*

(*electric, gravitational,* and *magnetic)* of elementary particles and to other important discoveries related to the above enumerated.

The results of corresponding studies, carried out on the new philosophical basis, which led to a series of the discoveries, were published in the course of last two decades and, therefore, they are not yet widely known for a scientific community. A relatively short time has passed after first publications in order to new results would be acknowledged, noticed and accepted by majority of scientists, and because of natural conservatism inherent in science. The first information about the dialectical view on physics has appeared in 1996 in the book "*Alternative Picture of the World*" by L. G. Kreidik (1931-2002) and G. P. Shpenkov.

In these **Lectures,** basing on fundamental concepts of dialectical physics, we will gradually reveal all stages on the way to the discovery of the nature of *mass* and *charge.* We will show also how we have arrived, in particular, at the discovery of the *wave nature of gravitation*, and at the discovery of the *fundamental frequency of gravitational wave field* of elementary particles, and so on. In the framework of the dialectical physics approach and on the basis of the aforesaid discoveries of new fundamental parameters, a *unified description* of fundamental interactions (*gravitational*, *electromagnetic*, and *strong*) became at last possible. It should be especially noted that this breakthrough has been made for the first time in physics, and this achievement will also be considered here.

So just due to the dialectical approach, realized in the dialectical Wave Model (WM), it made possible to untie a series of the fundamental problems, insoluble in modern physics. The *mass-charge problem* is one of them. In essence, it is the *problem on the structure of elementary particles*. A concept on the wave dynamic structure of elementary particles, realized in the wave *Dynamic Model*, turned out to be fruitful and perspective. The DM became the key for untie many problems. It was revealed the nature of both *mass* and electric *charge* of the particles, and was made the discovery of the *wave nature of gravitation* and defined therewith the *fundamental frequency* of gravitational fields. To the following key discoveries associated with the DM, we should mention the *shell-nodal structure of atoms* and an order of the disposition of nucleons in them, and also the first theoretical derivation of *relative masses of all atomic isotopes*.

It should be also especially noted that in the framework of the DM it became clear the reason of the dependence of *rest* energy of particles E_0 on the *speed* of light c explicitly expressed in the famous formula $E_0 = m_0 c^2$.

Lectures of **Vol. 1** are devoted to consideration of *philosophical and mathematical aspects* of a new approach that we have accepted. We call the latter dialectical, as it reflects the philosophical dialectical view on cognition of Nature.

Thus, as is repeatedly stressed, the specific feature of a new approach is its rest on dialectical philosophy and dialectical logic (dialectics). What is an essence of the dialectical approach in comparison with formal logical, accepted in modern physics, is considered in

Lecture 2 – the next one after this introductory. We elucidate there *the major concepts of the dialectical approach* that led to understanding the nature of mentioned above notions. This Lecture begins from considering the laws of "*right thinking*" of the formal logic showing their limited possibilities. We mean the laws of identity, noncontradiction, and excluded third. The postulates of dialectical logic: existence, dialectical contradictoriness of evolution, and affirmation-negation are considered in detail in their comparison with the formal logic as an inevitable, proper alternative to the latter.

Lecture 3 is devoted entirely to an *analysis of an advantage of the dialectical logic* on a concrete example. Namely, in view of the two logics, formal and dialectical, the notions of the "*real*" and "*imaginary*" points are considered in their direct comparison. The difference between mono judgments of formal logic and poly judgments of dialectical logic is demonstrated with this example in all details.

The *conjugate parameters* of dialectical physics: *displacement*, *speed*, *acceleration*, *state*, *charge*, *current*, *momentum*, *force*, and *energy*, are presented in **Lecture 4.** The physical meaning of "*imaginary*" parameters is revealed thereupon. Unfortunately, the lack in contemporary physics of a philosophical (dialectical) understanding of the physical meaning of "*imaginary*" numbers and their relation to "*real*" numbers, appeared at the description of physical processes by the field of complex numbers, has led to the development of abstract-mathematical quantum mechanical (QM) theory, which turned out (that follows from our analysis) to be erroneous and inadequate to reality.

The *dialectical field of binary numbers*, basically different from an existent field of numbers, is considered in **Lecture 5**. Every of two constituents of dialectical binumbers are obeying to one of the two algebras of signs.

A subject of **Lecture 6** concerns an important discovery made at an analysis of the dialectical field of binumbers. Namely, the fundamental period-quantum of dialectical binary numbers, which in essence is the period-quantum of the *Decimal Code* of the Universe, was found. This is a regularity of the Universal scale unknown to modern physics. It relates to an ideal side of the Universe, and is a fundamental parameter of the material-ideal numerical field. The value of the fundamental period-quantum of an ideal field of the *Decimal Numerical Base* and its influence on the metrology of nations are shown here. A relation of the fundamental period-quantum to the fundamental physical constants one can found in References at the end of this lecture.

Relativity of the notions "*real*" and "*imaginary*", the principle of complementability of the notions, further revealing the meaning of the imaginary unit *i* are considered in **Lecture 7**.

The dialectical field of binary numbers is an integral part of Dialectical Physics. The necessity to use the more general field of numbers, which is the binary numbers of dialectics, naturally follows from the data discussed in the Lectures. After revealing the meaning of the imaginary unit and imaginary constituents in complex numbers used in modern mathematics,

we have come to the conclusion that it makes sense to replace complex numbers with the dialectical binumbers, in which there are no imaginary terms.

A *bipolar character of physical processes*, biparameters of oscillations, bipolarity of the wave function, in particular, the symmetry and quasiperiodicity of the shell-nodal structure of atoms are considered in **Lecture 8**.

The *dialectical concept of time* is considered in **Lecture 9**. The notions of the ideal and the real times introduced in dialectical physics are analyzed. The *ideal* time is an absolute mathematical commonly used time (or *reference time*). The *real* times of natural processes are physical times. The wave equation of the time field-space is analyzed. It is shown that this equation reflects the universal law of dialectics – the law of negation of negation, or double negation.

Collected together all particular *axioms of the Wave Model*, based on: (1) dialectics and (2) a postulate on the wave nature of all phenomena and objects in the Universe, are presented in is the last **Lecture 10** of **Vol. 1.** The development of Dialectical Physics would be impossible without these axioms, because they constitute the basis of the Wave Model, including the Dynamic Model of elementary particles and the Shell-Nodal Model of atoms, resulted in a series of the aforementioned key discoveries.

Vol. 2 of the Lecturers is entirely devoted to the **Dynamic Model** of elementary particles developed on the basis of the concepts described in previous Lectures of **Vol. 1**. The DM is the unique theory existed today, which uncovers the origin of *mass* and the nature of electric *charge* of elementary particles. This model was developed by the authors of a book „*Alternative Picture of the World*" (1996) and described for the first time there. Further, different particular aspects of the model were discussed separately in a series of the relevant papers of the authors. We advise readers to pay attention to one of them entitled "*Dynamic Model of Elementary Particles and the Nature of Mass and 'Electric' Charg*e" published in 2001 and continuously available online [6].

An unexpected and conceptually new way in resolution of fundamental problems of physics, simplicity and clearness of the DM has confused at once physicists who have familiarized for the first time with the theory. It should be stressed that the DM cannot be regarded as one of the many casual inventions or a product of authors' imagination. The basis of its creation rests on a new paradigm, which takes into account thousand-year unquestioned achievements of the world philosophical thought, concentrated in dialectical philosophy and dialectical logic [7].

The wave **Shell-Nodal Model** of atoms is considered in **Lectures** of **Vol. 3**. They begin from a thorough analysis of quantum mechanical concepts. Important results of analyzing foundations of quantum mechanics (QM), in particular, Schrödinger's equation, regarding in QM as its major postulate, are considered in detail. Just a comprehensive analysis of the QM described in detail here has prompted us to reconsider the whole foundation of physics. All

the flaws of the QM, convincingly revealed to present time, led us to the conclusion on necessity to replace entirely an existing paradigm in physics as based mostly on the Aristotelian formal logic of limited possibilities and on abstract (fictitious) postulates.

Erroneous "solutions" of Schrödinger's equation (in fact they are the wishful thinking) led founders of the QM to an introduction of the conceptually unfounded notion of *hybridization of "atomic orbitals"*, comprising of mixing the qualitatively different ("*real*" and "*imaginary*") polar-azimuth functions. Unfortunately, the concept of *hybridization* taken as a basis in chemistry has initiated the development of modern quantum chemistry. We stress again that the *hybridization* is solely a mathematical operation of a *physically unrealizable mixing* of qualitatively opposite physical properties. We assume that it goes without saying; unreasonable theories built on the basis of erroneous concepts might not be accepted. Astoundingly, but why this did not understand creators of the QM in that time and do not understand their following up till now?

Subsequent Lectures that we intend to present in **Vol. 4** and **5** will contain additional convincing proofs of the efficiency of dialectical approach resulted in the following not mentioned in **Vol. 1-3**, important discoveries. In particular, an advantage of the dialectical WM in comparison with the SM is demonstrated by uncovering the real nature of *cosmic microwave background* (CMB) radiation, regarded in modern physics as "*relict radiation*" left after the Big Bang. We will show that hydrogen atoms, but not the mystic Big Bang, are responsible for the CMB radiations, being its source. The true nature of the *Lamb shift* phenomenon is revealed therewith. The so-called "*anomaly*" of the magnetic moment of the electron derived for the first time with a great precision beyond QED will also be considered there.

Physics is ripe for change and unambiguously needs in new paradigm for its basis. There is a pressing need to act immediately. The material contained in the Lectures responds to this objective. The comparative analysis of the modern Standard Model and the dialectical Wave Model, conducted in the Lectures at the consideration of different phenomena, justifies in favor of the undeniable advantage of the WM [8]. The complete replacement of an existing philosophical basis of modern physics upon the whole has turned out to be very effective. It cardinally changes situation in physics.

On the basis of the above described revelations and all other results obtained to now in a chosen direction, we can speak about a creation of the Dialectical Physics with its generalized theory of matter-space-time – the Wave Model. We regard this theory as an alternative to the Standard Model of modern physics [8, 9]. In the capacity of a textbook on Dialectical Physics, we can recommend the Ref. [9] as it contains the most complete material revealing in detail all the issues being considered in the Lectures.

The subjection of basic parameters of physical systems to general principles of dialectics evidences about their completeness. However, not many know what dialectics is and how its concepts are related to physics. For this reason we begin our Lectures (after this introduction)

from consideration of the aforementioned new philosophical background suggested for physics, *i.e.*, from dialectics. We will elucidate the basic concepts of dialectical logic in the light of their application to physics. This material, the subject of **Lecture 2,** represents an extremely brief review on dialectics intended for physicists. Therefore please do not be surprised if it is considered so concisely in the Lecture.

These basics, like alphabet, are highly necessary for understanding the essence and advantage of the dialectical approach. Especially it makes sense since most physicists are not familiar with philosophy and logic, in general, and with dialectical philosophy and dialectical logic, in particular. As uniquely capable to change in a cardinal way the unfavourable state in modern physics (fully-formed because of fundamentally doubtful concepts accumulated with time), the dialectical approach, we hope, will be unquestionably accepted by all scientific community. The only one question remains to be open, how soon will this happen?

References

[1] L. Kreidik and G. Shpenkov, "*Important Results of Analyzing Foundations of Quantum Mechanics*", Galilean Electrodynamics & QED-East, Special Issues 2, 13, 23-30, (2002); http://shpenkov.com/pdf/QM-Analysis.pdf

[2] G. Shpenkov and L. Kreidik, "*Schrodinger's Errors of Principle*", Galilean Electrodynamics, 3, 16, 51-56, (2005); http://shpenkov.com/pdf/blunders.pdf

[3] S. Shenker, *About ITP of Stanford University*, http://itp.stanford.edu/about.htm

[4] L. Simons, *Fundamental Interactions*, Chapter: "*Atomic and Condensed Matter Physics*" of the NuPECC report devoted to "*Impact and Applications of Nuclear Science in Europe*", 21-23 November, 2001 Dourdan (France).

[5] L. Kreidik and G.P. Shpenkov, "*Alternative Picture of the World"*, Volumes 1-3 (158, 164, and 186 pages; Bydgoszcz, 1996).

[6] L. Kreidik and G. Shpenkov, "*Dynamic Model of Elementary Particles and the Nature of Mass and 'Electric' Charge"*, Revista Ciencias Exatas e Naturais, Vol. 3, No 2, 157-170, (2001); http://shpenkov.com/pdf/masscharge.pdf

[7] *Antology of the World Philosophy*, Vol. 1 (Mysl, Moscow, 1969), Part 1.

[8] George Shpenkov, *Some Words About Fundamental Problems of Physics*, LAP LAMBERT Academic Publishing, 2012.

[9] L. Kreidik and G. Shpenkov, *Atomic Structure of Matter-Space*, Geo. S., Bydgoszcz, 2001, 584 p.

Philosophical and Mathematical Background

Lecture 2

Dialectics

1. The logic accepted in modern physics

A philosophical foundation of classical and contemporary physics is the formal metaphysical logic. Its habitual concepts, considered almost as dogmas, gave birth to a lengthy crisis and agnosticism, especially at explanation of subatomic and atomic levels of the Universe.

Formal logic was established by Aristotle (384 BC – 322 BC). The basic rules of the formal logic are the law of identity, the law of noncontradiction, and the law of the excluded middle. They were described in his principle philosophical work, “Metaphysics”.

At present, it usual to call these rules the laws of right thinking, although they are, in essence, the logical rules of metaphysics. These rules were in discordance with the contributions of antique dialecticians, and Hegel in Germany and Plekhanov in Russia revealed their limitations.

The *law of identity* claims: any judgment about a subject of thought must be definite and invariable in the course of reasoning, *i.e.*, "*A* is *A*", where *A* is any judgment. This rule is expressed by the formula

$$A = A \qquad \text{(the } \textit{law of identity}\text{)}. \qquad (1)$$

Thus, *Yes* is only *Yes*, and *No* is only *No*:

$$Yes = Yes, \qquad No = No \qquad (1a)$$

Of course, if a book is on the table then it seems only natural to state that only the book is on the table. So, in this sense, the law of identity is valid, but only for some time because, for example, the book can disappear, even in the process of judgment about it, and another subject, for example, a folder, can appear on the table in place of the book. It is an everyday situation. But, when we study physical processes, our thoughts and judgments must reflect a changing picture and be variable functional judgments *Yes*(*t*), *No*(*t*), so that a question about identity must not arise in such situations..

The *law of noncontradiction* states: a judgment about a subject of thought must not be simultaneously affirmative *A* and negative $\overline{A}$ – both of these cannot be true together. This rule is the first metaphysical support of the law of identity that is expressed by the following logical formula,

$$A \cap \overline{A} = \varnothing \qquad \text{(the } \textit{law of noncontradiction}\text{)}, \qquad (2)$$

where $\cap$ is the sign of crossing. So the expression $A \cap \overline{A}$ means the set of elements belonging to *A* and *B*. Thus, "*Yes* and *No*" is an empty set, $\varnothing$:

$$Yes \cap No = \varnothing \qquad (2a)$$

The *law of the excluded middle* states: at least, one of the two opposite judgments, *A* or $\overline{A}$, is the true one and the third is not given. This rule forms the second metaphysical support of the law of identity, expressed by

$$A \cup \overline{A} = I \qquad \text{(the law of the excluded middle)}, \qquad (3)$$

where *I* is the universal set represented in metaphysics by only *Yes* or *No* elements (or by both elements at once). The symbol $\cup$ is the sign of integration. So the expression $A \cup \overline{A}$ means the set of elements belonging to *A* or *B* (or to A and B together). Thus, "*Yes* and *No*" exhaust all judgments:

$$Yes \cup No = I \qquad (3a)$$

It should be noted also that in formal logic it is considered the fourth law, the *law of sufficient ground*; it is the so-called law of decidability, that any proposition which is valid

within a given theory may be proved or disproved. In 1931, Kurt Gödel disproved this thesis in his famous Gödel's Theorem, and we will not go into details of this law.

The algebra of judgments by Aristotle is valid, within definite bounds, as the algebra of contact elements in devices similar to robot systems, computers, *etc*., but not more. Formal logic cannot work in physics where all is in continuous motion. In particular, as soon as particles transform one into another, disappear and reappear, behave like waves and so on, formal logic gets into trouble.

At the base of classical and contemporary physics, based on formal logic, lies the model of the Universe, which can be called the model of one space, presented throughout the 19th century by the concept of '*world ether*'. The world ether was regarded as an initial level of the Universe. Today it is referred to as Dirac quantum vacuum, *etc*. Thus, in essence, the classical 'ether' was transformed into the *quantum 'vacuum***'**. The latter is interpreted as some primordial quantum-mechanical chaos, in which not necessity and chance together, but only chance, in connection with the indeterminacy principle, is presented.

One can say now that this model does not respond to the needs of the present time. For this reason, we propose to turn again to philosophy, as universal science, but this time to the *dialectical view* on the structure of the Universe [1, 2]. The laws of dialectical thinking studied by *dialectical logic* in the framework of *dialectics* are quite different from formal-logical laws. We proceed now to considering this subject in more detail.

2. What is dialectics?

Dialectics is an integral part of the foundation of world philosophy. The word "*philosophy*", in its original broad sense meaning "*the love of wisdom*", derives from the Greek compound *philosophia*, where the word *sophia* is ordinarily translated into English as "*wisdom*". According to Diogenes Laërtius (who probably lived in the early part of the third century), Pythagoras (c. 570-500 B.C., an Ionian Greek born on the island of Samos) was the first to begin to call philosophy *philosophia* (*i.e.*, the love of wisdom) and himself a philosopher (a wisdom-lover). By his words, only God can be the sage, but not a man …; and a philosopher (a wisdom-lover) is merely one who feels drawn to wisdom. Sages (and poets as well) were also called sophists (philosophizers).

Philosophy had two origins: one with Anaximander (610-546 B.C., born in Miletus), and the other with Pythagoras. Anaximander was the "pupil and successor of Thales", and he is regarded as the founder of Greek astronomy and natural philosophy. Thales of Miletus (c. 625-547 B.C.) is the first Milesian philosopher, the founder of the antique and generally European philosophy and science, and the founder of the Ionian school of natural philosophy. He proposed a simple doctrine on the origin of the world: he asserted that all variety of things

and phenomena originated from the single element – water. The first philosophy was called the Ionian philosophy; the second was called the Italian philosophy because Pythagoras was occupied with philosophy mainly in Italy.

Some philosophers were called *physicists* because they studied nature; others were referred to as *ethicists*, owing to their reasoning on morals and manners; a third group of philosophers were called *dialecticians* because of discussions on the justification of speech.

Physics, *ethics*, and *dialectics* are *three parts of philosophy*. Physics teaches about the world and all that is in it. Ethics is devoted to the life and behavior of humans. *Dialectics* is concerned with arguments for both physics and ethics. Until Archytas of Tarentum (a bright representative of the second-generation Pythagoreans who lived in southern Italy during the first half of the fourth century B.C.), a pupil of Anaxagoras of Clazomenae, *physics* was the only kind of philosophy. Anaxagoras of Clazomenae (who lived approximately during 500-428 B.C. and spent his most active years mainly at Athens) first taught philosophy professionally; he first advanced mind as the initiator of the physical world.

Dialectics originates with Zeno of Elea (c. 490-430 B.C.) [3]. Negating the cognition of the sensitive being, he showed in his famous paradoxes the contradictoriness of motion. Another of the founders of *dialectics* was Socrates (c. 469-399 B.C.).

The word *dialectics* meant, on the one hand, the search for truth by conversations, which were carried out through the formulation of questions and the methodical search for answers to them. On the other hand, *dialectics* means the capability of vision and reflection by means of notions of the opposite facets of nature.

In the wide sense of this word dialectics is a skill of many-sided description of an object of thought and a logic formation of the prediction of necessary and possible events. Thus**,** *dialectics is regarded as the logic of philosophy and all sciences, i.e.,* as *the logic of cognition on the whole*.

Dialectics represents a synthesis of the best achievements of both materialism and idealism and it is the ground for understanding of the material-ideal essence of the world. The *main laws* of dialectics are:

(1) the law of the unity and conflict of opposites;
(2) the law of the passage of quantitative changes into qualitative changes;
(3) the law of the negation of the negation

The main postulates of the dialectical philosophy are the following.

3. Postulates of dialectics

3.1. *The Postulate of Existence*

The material-ideal World ($\hat{M}$) exists ($\exists$):

$$\exists \hat{M} . \qquad (4)$$

Symbolically, the material-ideal essence of the world (Fig. 1) can be briefly presented by the logical binominal

$$\hat{M} = M + iR , \qquad (5)$$

where *M* and *iR* are, correspondingly, material and ideal components of the world, and the + sign expresses their mutual bond. Various worlds of the Universe and, in particular, the world of humans has the same structure. In the latter case *M* is a material human being or his biological body, material shell; *iR* is an ideal human being or his soul-mind.

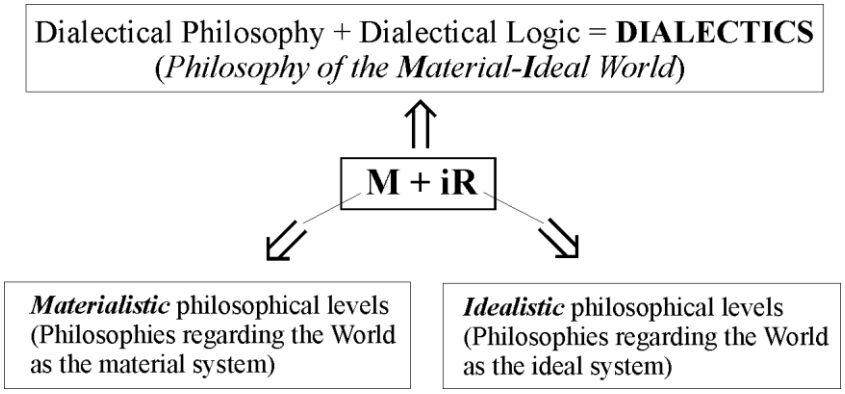

Fig. 1. A structural graph of dialectics.

All components ($\forall$) of the material-ideal world ($\hat{M}$), $\sum(s_k \circ f_k)$, are linked together by the system of symmetrically asymmetric dialectical relations σ_k, $\sum(s_k \sigma_k f_k)$, and ($\wedge$) by the relations of material-ideal exchange (ρ_k), $\sum(s_k \rho_k f_k)$. Symbolically, it can be expressed in the following form

$$\forall \sum(s_k \circ f_k) \propto \sum(s_k \sigma_k f_k) \wedge \sum(s_k \rho_k f_k) , \qquad (6)$$

where $k \in N$; s_k and f_k are contradictory sides of facets-oppositions of the Universe; $\propto$ is the symbol of the infinite universal relation; "$\circ$" is the symbol-pronoun of any relations.

3.2. ***The Postulate of Dialectical Contradictoriness of Evolution***

Any object or relation *A* in any instant is in a state of evolution, *i.e*., it simultaneous equals and does not equal itself:

$$(A = A) \wedge (A \neq A), \qquad (7)$$

where $\wedge$ is the sign of logical conjunction. The following logical antinomy corresponds to the aforementioned binomial judgment:

$$(Yes = Yes) \wedge (Yes \neq Yes). \qquad (8)$$

Dialectics states that "*A* is *A*" and "*A* is not *A*" simultaneously. For example, Smith as child, youngster, man, and old man is, on the one hand, the realization of the logical formal formula "*A* is *A*", *i.e*., Smith is Smith. On the other hand, the child-youngster-man-old man series is the manifestation of the nontautology "*A* is not *A*", *i.e*., Smith continuously changed and Smith as a child is not equal to Smith as a youngster. At every instant he is he, "*A* is *A*", and simultaneously he is not he, "*A* is not *A*". When we consider fast-changing physical processes at the molecular level or deeper, the truth of this postulate becomes yet more obvious.

The logical binominal of evolution "*A* is equal to *A* and, simultaneously, *A* is not equal to *A*" is beyond the bounds of formal Aristotelian rules. Aristotle (384-322 B.C.), who laid the foundation of metaphysics and formal logic, was an opponent of dialectics. He wrote [4], "There are however people which, as we pointed to, themselves speak that the same can exist and non-exist together and assert that it is impossible to hold this point of view. Many among explorers of nature turn to this thesis." According to metaphysics, two formally logical judgments *A* (*Yes*) and *A* (*Yes*) are always assumed to be *only equal* through the *law of identity*: *A* = *A* (*Yes* = *Yes*). This tautology excludes any possibility of motion and analysis, and if humans followed this rule in fact, the development of human thought would be impossible.

3.3. ***Postulate of Affirmation of Dialectical Logic***

(a) A brief dialectical judgment about an object of thought is presented, in a general case, by the symmetrically asymmetric logic structure *Yes*-*No* or *No*-*Yes*.

(b) Relatively symmetric objects are expressed by the logical structure *Yes*-*Yes*, or briefly *Yes*, and relatively asymmetric by the structure *No*-*No*, or briefly *No*.

(c) In a general case, a logical dialectical judgment *L* is the function of the elementary judgments *Yes* and *No*,

$$L = f(Yes, No) \qquad (9)$$

4. The ***Postulate of Measures of Dialectical Judgements***.

Measures of judgements *Yes* and *No* have multiplicative character:

$$P = Q \cdot D ,$$

where Q is the quantitative measure of a judgement, D is its qualitative measure or dimensionality.

Dialectical physics in the capacity of reference (fundamental) units of the triad of matter-space-time accepts only three units: the *gram*, the *centimeter*, and the *second*.

Because cognition occurs on the basis of comparison, therefore, the correct structure of dimensionality has to be presented by the product of the reference units to the integer powers:

$$D = \dim P = M^k L^m T^n ,$$

i.e. $k, m, n \in Z$. Here, reference measures of the triad are designated by the symbols *M, L* and *T*.

A definite opinion is shared among researchers that the choice of the triad is quite arbitrary. However, it is not the case and we show it in our works. Measures chosen by men are induced by experience of intercourse with surrounding Nature, and these measures belong to the definite set of possible values. A great many people suppose that it is possible to take in the capacity of the measure, for example of mass, any value, but this is an illusion. An arbitrary value of mass will not to be accepted if this value will not to belong to the definite set of possible values of mass. It pertains also to length. As the measures of length, the inch, the foot, and other not metric units can be used, but all these measures are related to the possible set of units.

As concerns compound units, we are in such a state when in physics of electromagnetic processes the basic physical parameters, such as the electron charge and others, are presented by the dimensionalities with fractional powers of fundamental units. Such compound units are incorrect and, consequently, from the dialectical point of view, these are not true units. Conditionally, these units can be called phenomenological ones. Cognition of Nature is impossible when using such units, because these are beyond comparison. Indeed, the electronic charge is determined by the measure

$$e = 1.60217733 \cdot 10^{-19}\ C.$$

However, the unit of electric charge, the *coulomb*, is the term of the inconceivable value at fractional powers of reference units, which cannot be comparable to something:

$$1C = 2.99792458 \cdot 10^{9}\ g^{1/2} \cdot cm^{3/2} \cdot s^{-1}$$

Actually, can somebody show the object of $1g^{1/2}$? Naturally, nobody can do it because such an object does not exist in Nature. Further, can somebody show in Nature the volume of $1cm^{3/2}$? It is impossible as well. The dialectical postulates state that the electron, presented in the above-mentioned form, is inconceivable. A solution to this cardinal problem of modern physics (the dimensionality problem) is described in detail in the book [1].

Cognition of the World proceeds on the basis of comparison and through comparison. In the first approximation any element of a state or a phenomenon of nature has at least two sides of comparison. This requests us to describe *A* by dialectical symmetrically asymmetric judgments of the kind *Yes-No*. The last presents the symmetrical pair of judgments *Yes* and *No*, which are in essence the opposite judgments, so that in this sense both these judgments are asymmetric ones.

In a general case, *Yes* and *No* are natural judgments about an object of study. They express *quantitative* and *qualitative* measures of the object. Here are some examples of polar-opposite notions: rest-motion, potential-kinetic, continuous-discontinuous, absolute-relative, existence-nonexistence, material-ideal, form-contents, basis-superstructure, qualitative-quantitative, cause-effect, objective-subjective, past-future, necessary-casual, finite-infinite, real-imaginary, wave-quantum, particle-antiparticle, *etc*.

Chuang Tzu (c. 369-286 B.C., an outstanding representative of Taoism) has written [4, p. 215], “In the World, everything *denies* itself through the other thing, which is its opposition. Every thing states itself through itself. It is impossible to discern (in the one separately taken thing) its opposition, because it is possible to perceive a thing only immediately. This is why, they say: ‘*Negation* issues from *affirmation* and affirmation exists only owing to negation’. Such is the doctrine on the conditional character of negation and affirmation. If this is so, then all dies already being born and all is born already dying; all is possible already being impossible and all is impossible already being possible. Truth is only insomuch as, inasmuch as lie exists, and lie is only insomuch as, inasmuch as truth exists. The above stated is not an invention of a sage, but it is the fact that is observed in nature…”.

Another Chinese philosopher Ch’eng Hao (1032-1085) has said [3] (p. 327): “The highest principle for all things in heaven and on the Earth is that there is not one single thing that is independent, because, it is obligatory, there is its *opposite*…” In other words, *all things do not*

represent a single whole, but these exist in the form of opposites. His brother Ch'eng I (1033-1107) has stated: "Everything in the space between heaven and the Earth has opposites; if there is the Dark Beginning then the Light One also is; if well is, hence evil is as well", *etc*.

For the description of the *opposite* properties of objective reality it is convenient to use *complex numbers*, as the numbers with polar opposite algebraic properties [6]. The transformation of the kinetic field into the potential one, or the *electric* field into the *magnetic* one, means (in the language of complex numbers) the transformation of the "*real*" numerical field into the "*imaginary*" one, and *vice versa*.

Thus, as follows from the basic law of dialectics *Yes-No* (the law of symmetry and asymmetry *Yes* and *No* of the polar judgments), *motion-rest must be described by the conjugate symmetrical parameters*. Disregard of the law leads, to put it mildly, to disagreeable consequences for science (see, *e.g.*, [1, 7, 8]).

Correspondingly, the *kinetic speed* (the first time derivative of kinetic displacement) as the speed of change of motion must be conjugate with the *potential speed* of change of rest. This supposes the supplementation of the *kinetic momentum* with the *potential momentum*. We must operate also with the *potential* and *kinetic force, potential* and *kinetic work,* along with the already-existed *potential* and *kinetic energy*. Contemporary physics did not develop the notion of the *potential-kinetic wave field,* which could be regarded as a generalized image of any real physical field (electromagnetic, for example).

It is natural that the above problems also concern the description of the *field of physical (real) time* (an *ideal field-space* of the universe), which enters in the triad of *matter-space-time* and differs from the *reference* (mathematical) *time* used everywhere. An introduction of the abovementioned missing conjugate notions (parameters) one can find in [9].

4. Conclusion

Thus, in contrast with metaphysics, *dialectics states* that the World is objective dialectics, which is effectively described on the basis of subjective dialectics (dialectical philosophy and its logic) by basic notes-judgments of dialectics

Yes, No, Yes-Yes, No-No, Yes-No

and more complicated accords as

Yes-Yes-No, etc.

Dialectical judgments are variable ones. They are changed in accordance with the change of a subject of thought, *i.e*., in a general case, any judgment *A* must satisfy the *law of motion* which can be presented, in terms of sets, by the antinomy (7),

$$(A = A) \wedge (A \neq A),$$

which states that a judgment must be variable, reflecting variable processes in nature, *i.e*., being equal itself it must not be equal itself.

Dialectics is a skill of many-sided description of an object of thought and a logic formation of the prediction of necessary and possible events. The essence of the *dialectical model* of an arbitrary state or process is the fact that any property of the Universe, denoted by the limiting brief judgment **Yes**, always responds (without any exceptions) to the property **No**. This fundamental rule is the fundamental principle of the 'dialectical model' that thus claims that any **Yes** has its own negation **No**. Moreover, there is not a clear boundary between **Yes** and **No**: many properties of **Yes** continuously and discontinuously turn into the opposite properties **No**. For example, it is the continuous transfer of potential energy into kinetic one, and conversely, at oscillation of a pendulum, *etc*.

The logical perception of an object of thought and its dialectical aspects by means of polar-opposite judgments like similarity-difference, analysis-synthesis, deduction-induction, general-particular, contents-form, abstract-concrete, correct-incorrect, *etc*., and, generally, by the dialectical judgments **Yes-Yes, Yes-No, No-Yes, No-No** and their combinations, based on comparison, is the effective process of cognition of the object of thought. The core of the **Yes-No** logos is the main law of the dialectical logic from which any combinations of **Y**es and **No** follow.

Thus, the symmetry of a pair **Yes-No** is the foundation of the dialectical model of the Universe, resting upon the fundamental law of dialectical logic – the law of *affirmation-negation*.

References

[1] L. Kreidik and G. Shpenkov, *Atomic Structure of Matter-Space*, Geo. S., Bydgoszcz, 2001, 584 p.

[2] L. Kreidik and G.P. Shpenkov, *Alternative Picture of the World*, Volumes 1-3 (158, 164 and 186 pages; Bydgoszcz, 1996).

[3] Zeno of Elea, *On the Life, Doctrines, and Dicta of Famous Philosophers* (Mysl, Moscow, 1979), pp. 66-67.

[4] J.L. Ackrill, *Aristotle: Categories and De Interpretatione* (Calendon Press, Oxford, 1963; W.D. Ross, *Aristotle's Medtaphysics* (Calendon Press, Oxford, 1924).

[5] *A History of Chinese Philosophy* (Progress, Moscow, 1989).

[6] L. Kreidik and G. Shpenkov, *Philosophy and the Language of Dialectics and the Algebra of Dialectical Judgments*, Proceedings of The Twentieth World Congress of Philosophy, Boston, 1998; http://www.bu.edu/wcp/Papers/Logi/LogiShpe.htm

[7] L. Kreidik and G. Shpenkov, "*Important Results of Analyzing Foundations of Quantum Mechanics"*, Galilean Electrodynamics & QED-East, Special Issues 2, **13**, 23-30, (2002); http://shpenkov.com/pdf/QM-Analysis.pdf

[8] G. Shpenkov and L. Kreidik, "*Schrodinger's Errors of Principle"*, Galilean Electrodynamics, 3, **16**, 51-56, (2005); http://shpenkov.com/pdf/blunders.pdf

[9] G. Shpenkov and L. Kreidik, *Conjugated Parameters of Physical Processes and Physical Time*, Physics Essays, Vol. 15, No. 3, 339-349, (2002).

Lecture 3

Judgments of Formal and Dialectical Logics

1. Difference between mono- and polyjudgments

Metaphysical (formal) logic is the *marginal schizologic of monojudgments* of the single-measured kind "*Yes*" or "*No*". Dialectical logic is the *logic of polyjudgments*, which in the simplest situations is presented by binary judgments referred to as "*Yes-Yes*", "*Yes-No*", "*No-Yes*", and "*No-No*". In a general case, the polyjudgments are presented by multi-measured judgments consisting of the elementary dialectical judgments "*Yes*" and "*No*".

Let us consider, in concrete examples, what difference is between judgments (about the same object of thought) of the marginal schizologic and the dialectical logic. We assume that it is the appropriate time to show both logics implemented. It is a better way, than engaging, by tradition, in prolonged disputes on the importance of metaphysical (formally logical) and dialectical methods of judgments dating back to Heraclitus's and Aristotle's time (fifth and forth centuries B.C.).

In the geometrical section of physics, there are notions of "*real*" and "*imaginary*" points. These notions have been formed on the basis of three rules of formal logic: the *law of identity*, the *law of noncontradiction*, and the *law of excluded third*. The law of noncontradiction is usually called the law of contradiction, although, in essence it requires the exclusion of contradictions from the arsenals of logical analysis.

It is accepted to regard the aforementioned rules as the basic "*laws of right thinking*". Let us consider the efficiency and validity of these laws.

1. A point of intersection of two beams (Fig. 1) is called in the formal logic the "*real point* 1" or briefly "*Yes*". Namely, the meaning "*Yes*" is the "*real point* 1" or "*Yes*" = "*real point* 1".

The dialectical logic calls this the "*really-real* or *binary-real point* 1", i.e., the point "*Yes-Yes*". Thus, "*Yes-Yes*" = "*binary-real point* 1".

2. The formal logic calls a point of intersection of one beam with a mental continuation of the other beam the "*imaginary point* 2" or briefly "*No*", i.e., "*No*" = "*imaginary point* 2".

The dialectical logic calls this the "*really-imaginary* point 2", i.e., the point "*Yes-No*". Thus, "*Yes-No*" = "*really-imaginary point* 2" that correspond to reality.

3. A similar situation is the case of the third point, which in accordance with the formal logic is the point "*No*", but following the dialectical logic it is the point "*No-Yes*" that insignificantly differs from the point "*Yes-No*". The formal logic does not distinguish a difference between them because it denotes both the second and the third points by only one judgment, "*No*" which is unconditionally incorrect.

4. The point of a mental intersection of continuations of two beams is called in the formal logic the "*imaginary point* 4", or briefly "*No*", i.e., "*No*" = "*imaginary point* 4". The dialectical logic calls this point the "*imaginary-imaginary point* 4", i.e., the point "*No-No*". Thus, "*No-No*" = "*imaginary-imaginary point* 4" and this is the fact.

5. If points of intersection of two pairs of beams, from different optical objects, superimpose on each other, then a composite point is formed. The formal logic calls this the "*real point* 5", or briefly "*Yes*", i.e., "*Yes*" = "*real point* 5". The dialectical logic calls this the "*double really-real point* 5", or the "*point of the real quartet* 5", i.e., the point "(*Yes-Yes*)-(*Yes-Yes*)" with the meaning "(*Yes-Yes*)-(*Yes-Yes*)" = "*point of the real quartet* 5".

6. The point 6, formed as a result of confluence of the points "*Yes-Yes*" and "*Yes-No*" from different optical objects, is called by the formal logic the "*real point* 6", i.e., here as well, "*Yes*" = "*real point* 6". The dialectical logic calls this the "*point* 6 *formed of confluence of double points*: *the really-real and really-imaginary ones*". In other words, it is the "*point of the logically not uniform quartet* 6", i.e., the point "(*Yes-Yes*)-(*Yes-No*)" with the meaning "(*Yes-Yes*)-(*Yes-No*)" = "*point of the logically not uniform quartet* 6".

7. An analogous (as in the case with item 6) situation takes place in the case with the point 7, which is a logically not uniform quartet of the kind "(*Yes-Yes*)-(*No-Yes*)". The formal logic will call this point "*Yes*".

8. Evidently, a dialectical logical structure of the point 8 is *not* a *uniform quartet of the kind* "(*Yes-Yes*)-(*No-No*)", which the formal logic calls only the point "*Yes*".

From the eight points considered above, only three, 1, 4, and 5, have the *logically noncontradictory structure*. The rest are *logically contradictory points*. The contradictory structure of the points 2, 3, 6, 7, and 8 has the character of a *static contradiction*.

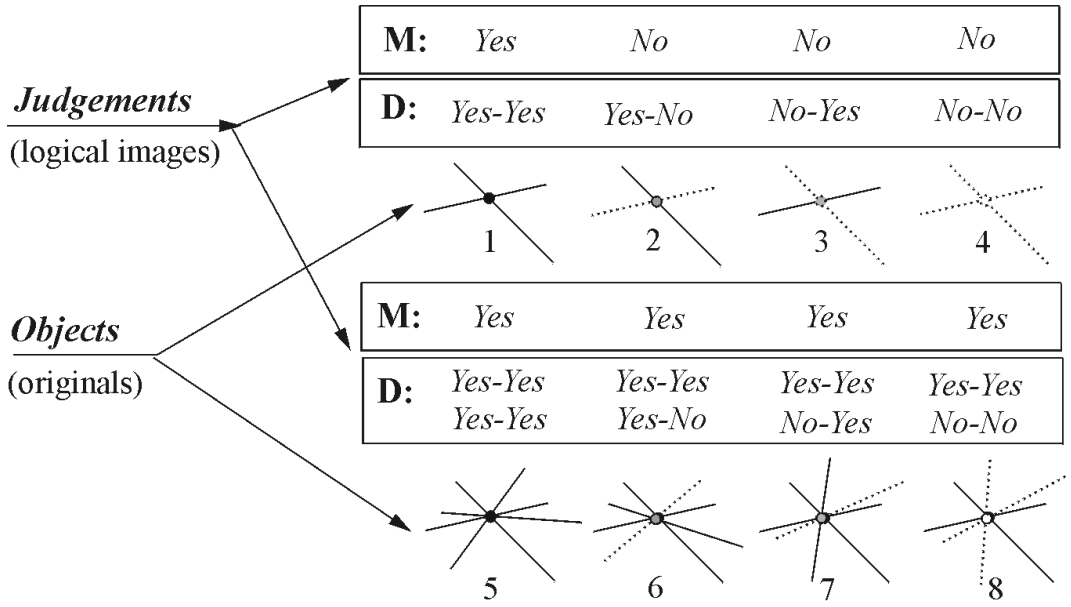

Fig. 1. Elementary points of the geometrical optics and the logic of metaphysical (**M**) and dialectical (**D**) judgments.

The short judgments of the kind: "*Yes*", "*No*", "*Yes-Yes*", "*Yes-No*", "*No-Yes*", "*No-No*", etc. represent by themselves the *logical names of the points*.

By means of the symbolic language, it is possible to express the above-considered judgments (about the kinds of the points) in the following way.

Let us denote any of the eight points by the symbol X_k, where k is the number of the point. Its opposite characteristics will be denoted by the symbols A and B with the meanings $A = R$ and $B = I = unR$, where R is any word-formation of the word "*real*" and I is any word-formation of the word "*imaginary*" (unreal *unR*). The symbol $\wedge$ will be equivalent to the conjunction "*and*". Evidently, R and unR have also the logical meanings: R = "*Yes*" and unR = "*No*". The logical meanings define the logical name of the point.

Using the accepted designations, the short symbolic qualitative judgments about the point can be presented in the following way.

1. **M**-judgment: $X_1 = R$ is the "*real point* 1",

   D-judgment: $X_1 = R \wedge R$ is the "*binary-real point* 1"

   (the point of noncontradictory structure, the noncontradictory point);

2. **M**-judgment: $X_2 = unR$ is the "*imaginary point* 2",
   D-judgment: $X_2 = R \wedge unR$ is the "*really-imaginary point* 2"
   (the contradictory point);
3. **M**-judgment: $X_3 = unR$ is the "*imaginary point* 3",
   D-judgment: $X_3 = unR \wedge R$ is the "*imaginary-real point* 3"
   (the contradictory point);
4. **M**-judgment: $X_4 = unR$ is the "*imaginary point* 4",
   D-judgment: $X_4 = unR \wedge unR$ is the "*imaginary-imaginary point* 4"
   (the noncontradictory point);
5. **M**-judgment: $X_5 = R$ is the "*real point* 5",
   D-judgment: $X_5 = (R \wedge R) \wedge (R \wedge R)$ is the "*point of the real quartet* 5"
   (the *noncontradictory* point);
6. **M**-judgment: $X_6 = unR$ is the "*imaginary point* 6",
   D-judgment: $X_6 = (R \wedge R) \wedge (R \wedge unR)$ is the "*point of the compound quartet* 6"
   (the *contradictory* point);
7. **M**-judgment: $X_7 = R$ is the "*real point* 7",
   D-judgment: $X_7 = (R \wedge R) \wedge (unR \wedge R)$ is the "*point of the compound quartet* 7"
   (the *contradictory* point);
8. **M**-judgment: $X_8 = R$ is the "*real point* 8",
   D-judgment: $X_8 = (R \wedge R) \wedge (unR \wedge unR)$ or $X_8 = (R \wedge R) \wedge un(R \wedge R)$
   is the "*point of the compound quartet* 8"
   (the *contradictory* point).

Graphs of the points, presented in Fig. 1, are dialectical diagrams-images of the corresponding dialectical judgments. If we digress from the contents of the judgments, then we can introduce abstract diagrams of judgments about the points, like **John Venn's** (1834-1923, an English logic scientist) formal logical diagrams. For this purpose, let us agree that there affirmative judgments, which will be presented in the form of ellipses or circumstances, while negative judgments will be presented in the form of triangles. The types of judgments of the first four characteristic points, presented in Fig. 2, clearly show the different logical "geometry" of metaphysical and dialectical judgments.

2. Peculiarities of the logical diagrams of the judgments

Let us consider now the peculiarities of the logical diagrams of the dialectical judgments, regarding the points, and compare them with the logical diagrams of the formal logic.

According to metaphysics, two formally logical judgments *R*(*Yes*) and *R*(*Yes*) are always assumed to be *only equal* through the *law of identity*: *R* = *R* (*Yes* = *Yes*). This metaphysical rule of the marginal schizologic seems to be indisputable, although Hegel has showed its conditional character.

Now, we will analyze the law of identity in detail. For this, we will turn to the real fact presented by the point 1. Here, we have two judgments *R*(*Yes*) and *R*(*Yes*), which are related to the structure of the point. These judgments are equal in the contents, but they are unequal in the form. Indeed, in the contents, these are equal because these judgments have the equal meanings of the word "*real*": *R* = *R* = "*real*". But in the form, they are unequal judgments: *R* ≠ *R*, because they reflect the different localization in space of the originals of these judgments, not coinciding spatially. Hence, the multivariateness of dialectical judgments in the space of our thought, distinguishing them from univariate metaphysical judgments, is distinctly shown here.

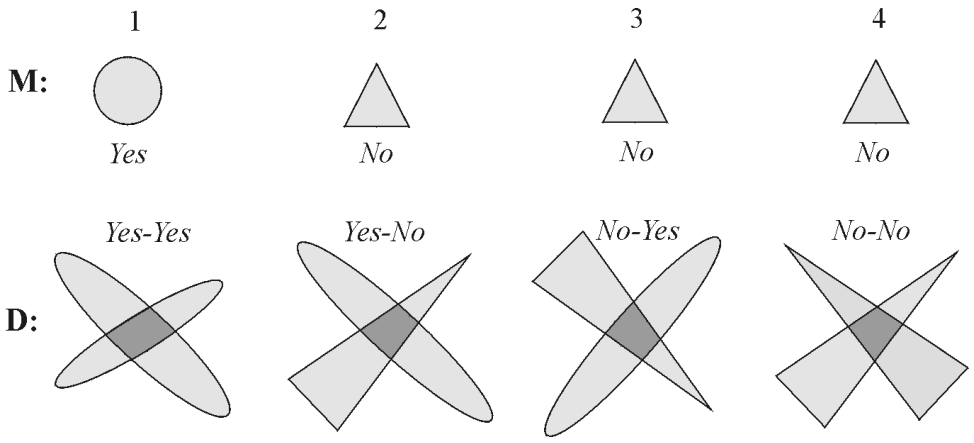

Fig. 2. Logical diagrams of the characteristic points 1, 2, 3, and 4; **M** is the *metaphysical monojudgments*, or *Yes* or *No*, representing these points; **D** is the *dialectical binary judgments* on the basis of the elementary judgments *Yes* and *No*, their intersections (depicted by the dark background) symbolize the points: $X_1 = R \wedge R$, $X_2 = R \wedge unR$, $X_3 = unR \wedge R$, $X_4 = unR \wedge unR$.

Thus, in the dialectical logic, the relation of judgments *R*(*Yes*) and *R*(*Yes*), describing the point 1, is presented by *the qualitative logical formula* in the form of the antinomy (binomial judgment):

$$(R = R)_C \wedge (R \neq R)_F, \qquad (1)$$

which claims that the *equal judgments R* and *R* are *simultaneously unequal.* Actually, these judgments are equal on the one hand – with respect to their contents *C* (from the Latin, *continens* = contents)), but they are unequal on the other hand – with respect to their form *F* (from the Latin, *forma* = form).

Owing to the judgments, which satisfy the binomial judgment, they exactly reflect, in the dialectical sense (i.e., both in the contents and in the form), the notion of the *really-real* point 1.

The following *logical antinomy* corresponds to the binomial judgment (1):

$$(Yes = Yes)_C \wedge (Yes \neq Yes)_F. \qquad (2)$$

The dialectical logical formulae (1) and (2) give us the clear and definite information about the structure of the point 1 that is impossible to express in framework of the formal logic. The latter presents only one *R* (*Yes*), creating an illusion of accuracy and definiteness.

As is well known, any word not only calls an object of thought, but it is also characterized by the definite meanings (Fig. 3).

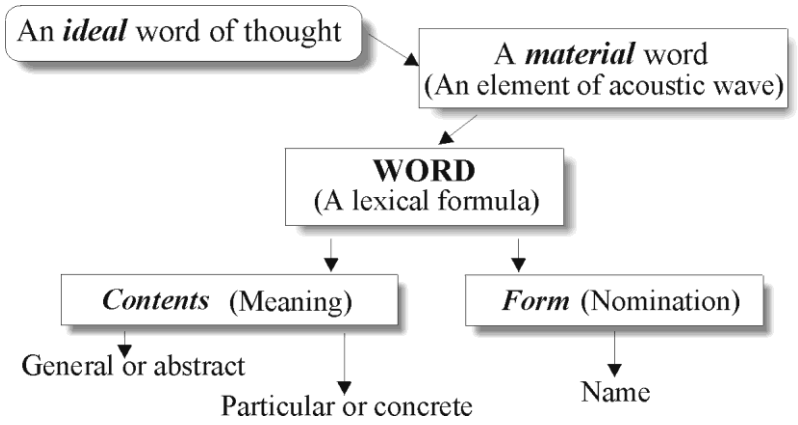

Fig. 3. A graph of a word.

A word-combination the "*really-real point* 1" is a complex word, which, except the name, expresses the definite meaning, the simplest essence of the called object. The name of a point and its meaning is expressed by the symbol X_k.

Every word has also its logical name. In the above-considered case with the word expressed by the symbol X_1, its logical name is presented by the expression $R \wedge R$, or $Yes \wedge Yes$. The logical meaning of this name is expressed by a system of the logical content and form by the antinomy (1) or (2).

The formally logical identity

$$R = R, \qquad (3)$$

corresponding to the dialectical antinomy (1), can sometimes explain (although with big difficulty) something in common life, but not more.

In examples, presented in Fig. 2, the logical conjunction $\wedge$ expresses the intersection of beams; therefore, in this sense, its logical meaning is the "*intersection*": $\wedge =$ "*intersection*". The *dialectical conjunction* $\wedge$ is the subjective image of the objective "*intersection*"; therefore, in this sense, it is essentially distinguished from the *formally logical conjunction*. The dialectical conjunction participates in the definition of names of the points, for example,

$$X_1 = R \wedge R,\ X_2 = R \wedge unR, \quad X_3 = unR \wedge R, \quad \text{and} \quad X_4 = unR \wedge unR. \tag{4}$$

At the level of marginal schizologic, the following judgments correspond to the equalities-judgments (4):

1. the law of idempotentity

$$R \wedge R = R \ \neq X_1, \tag{5}$$

2. the laws of noncontradiction, referred to as the laws of contradiction,

$$R \wedge unR = \varnothing \ \neq X_2, \tag{6}$$

$$unR \wedge R = \varnothing \ \neq X_3; \tag{7}$$

3. the law of idempotentity

$$unR \wedge unR = unR \ \neq X_4. \tag{8}$$

The expression (5) means that an intersection of two beams is the beam equal to any of them, because, following the marginal schizologic, $R = R$, whereas in reality $(R = R)_C \wedge (R \neq R)_F$.

Thus, ignoring the elementary dialectical inequality $(R \neq R)_F$, the formal logic asserts that under intersection of *Yes* and *Yes* we will again have *Yes*, i.e., *instead of the real point we have the real line*. The absurdity is evident. The above-obtained conclusions are valid for Eq. (8) as well.

As concerns formulae (6) and (7), we deal here with a very disagreeable situation: the real-imaginary and imaginary-real points cannot exist from the point of view of the marginal schizologic, which is symbolized by the sign of the empty set $\varnothing$.

Comparing the dialectical judgments, entering in formulae (4), with similar to them metaphysical judgments - formulae (5) – (8), we can see, as much the latter distort the logical picture of objects presented in Fig. 2. Since metaphysical judgments give us, already just here, the incorrect logical picture, then, the question is: could these judgments be a reliable logical instrument for serious scientific and philosophical studies? Of course, they could not be!

The next question arises: can the formally logical equality (5) be a particular case of the dialectical equality? Yes, it can be! In such the case, it has the form

$$R \wedge R = R = X_1. \qquad (9)$$

Obviously, this equality expresses a case when beams-judgments *R* and *R* are parallel and coincident. However, an intersection of such beams-judgments is not a point, but the beam X_1 equals one of two initial beams. Thus in dialectics, the "*law of idempotentity*" $R \wedge R = R$ takes place only when dialectical judgments are "parallel" and coincident. When we speak about a parallelism, we mean the parallelism in the space of our thought, which is a logical image of the parallelism in the objective space.

If *R* (*Yes*) and *R* (*Yes*) are parallel but not coincident, then obviously, no intersection is, that is expressed by the symbol of the empty set $\varnothing$. Thus, the following two laws of the dialectical idempotentity of parallel judgments correspond to the formally logical law of idempotentity (9):

$$R \wedge R = R \quad \text{and} \quad R \wedge R = \varnothing. \qquad (10)$$

If we will designate the parallelism of the coincident and not coincident judgments by the indexes "↑c" and "↑n", correspondingly, the equalities (10) take the following form

$$R_{\uparrow c} \wedge R_{\uparrow c} = R_{\uparrow c} \quad \text{and} \quad R_{\uparrow n} \wedge R_{\uparrow n} = \varnothing. \qquad (11)$$

Let us analyze now the formally logical law of noncontradiction (3.6),

$$R \wedge unR = \varnothing, \qquad (12)$$

in a case when dialectical judgments *R* and *unR* are the parallel ones and, at that, these judgments do not coincide spatially. Obviously, in this particular case, judgments are not intersected. However, if they are parallel and spatially coincident, then, we arrive at the tautology, unequal to the empty set, because it determines the same really-imaginary line:

$$R \wedge unR = R \wedge unR \neq \varnothing. \qquad (13)$$

Hence, two dialectical laws correspond to the formally logical law of noncontradiction (6), namely:

$$R \wedge unR = \varnothing, \quad \text{and} \quad R \wedge unR = R \wedge unR \neq \varnothing. \qquad (14)$$

Thus, a principle of thinking "either that or this", i.e., "either Yes or No", originating from the formally logical rules (claiming the clearness, unambiguousness, and correctness of the reflection of objective properties of objects and phenomena), does not correspond to the facts. As follows from the above-presented analysis (with the simple examples of geometrical optics), this specific metaphysical principle manifests both its inaccuracy and uncertainty. By

contrast with the formal logic – "contradictory and indefinite", the dialectical logic gives the exact and definite description of the character of optical points.

The formally logical description (i.e., the separating monodescription – schizodescription – of the single-measured character) cannot be compared, in accuracy and definiteness, with the dialectical logic – the logic of antischizodescription of polyjudgments of the multi-measured character. This is why, Hegel wrote in his time in "Phenomenology of Spirit": "Our time is the time of birth and transition to the new period", which we quite definitely can call the "dialectical period".

Dialectics is the foundation of scientific thought already at the beginning of the third millennium. Appearance of the new trend, Neo-Hegelianism, in the Western philosophy at the boundary of the 19-20th centuries points to that. Neo-Hegelianism appeared on the basis of a new interpretation of Hegel's dialectical method and doctrine about the spirit and as a result of the deep crisis of the scientific foundation of natural history.

A transition from the level of Aristotle's elementary metaphysical logic to the level of the highest logic of dialectical philosophy is inevitable for the scientific thought and this process cannot be stopped.

3. The dynamic picture: an analysis of elementary micro displacements

Using the language of dialectics, we have considered above the static picture of the objective reality. Let us turn now to an analysis of an elementary microdisplacement of some material point *M*, the position of which in space is characterized by the vector $\mathbf{r}(t)$ determining its trajectory *L*. We will designate an arbitrary point of the trajectory by the symbol *P*.

The point *M*, moving along the trajectory *L*, does pertain and, simultaneously, does not pertain in every instant *t* to some point *P* of the trajectory.

The language of *dialectical logic* expresses motion of the point *M* simply and naturally as

$$(\mathrm{M} \in \mathrm{P}) \wedge (\mathrm{M} \notin \mathrm{P}). \qquad (15)$$

It is necessary to supplement this judgment with the dialectical binary judgment for the vector function itself $\mathbf{r}(t)$ and time *t*:

$$\big(\mathbf{r}(t) = \mathbf{r}(t)\big) \wedge \big(\mathbf{r}(t) \neq \mathbf{r}(t)\big), \qquad (\mathrm{t} = \mathrm{t}) \wedge (\mathrm{t} \neq \mathrm{t}). \qquad (16)$$

We will designate the motion by the symbol D, the first components of the antinomies (judgments) (15) and (16) – by the symbol A, and the second ones – by the symbol nonA or briefly $\overline{\mathrm{A}}$ (with the corresponding subscripts):

$$A_M = (M \in P), \qquad \overline{A}_M = (M \notin P),$$

$$A_r = \left(\mathbf{r}(t) = \mathbf{r}(t)\right), \qquad \overline{A}_r = \left(\mathbf{r}(t) \neq \mathbf{r}(t)\right),$$

$$A_t = (t = t), \qquad \overline{A}_t = (t \neq t).$$

Then, all three judgments will take the following form

$$D_M = A_M \wedge \overline{A}_M, \qquad D_r = A_r \wedge \overline{A}_r, \qquad D_t = A_t \wedge \overline{A}_t. \tag{17}$$

Evidently, it is possible to present them by the single dialectical formula

$$D = A \wedge \overline{A}. \tag{18}$$

This antinomy is the qualitative logical formula of all three formulae of motion of the point M. The symbol A means an equality and $\overline{A}$ - an inequality of something in a wider sense of the word. Because the equality A is variable one, it also satisfies the qualitative formula of motion. Designating the variable equality by the symbol V, we have

$$V = \left((A = A) \wedge (A \neq A)\right). \tag{19}$$

Further, since to be somewhere A and not to be there $\overline{A}$ are two sides of the same motion, these are equal and unequal at the same time with the same relation:

$$\left((A = \overline{A}) \wedge (A \neq \overline{A})\right). \tag{20}$$

According to *formal logic*, the following expressions represent the empty sets:

$$(A \neq A) = \varnothing, \qquad (A = \overline{A}) = \varnothing, \qquad D = A \wedge \overline{A} = \varnothing. \tag{21}$$

This means that if to follow formal logic, the marginal schizologic with its laws of the *"right thinking*", "*contradiction*" and "*excluded third*", we come to the conclusion that motion does not and cannot exist. Actually, the aforementioned laws of formal logic represent by themselves the two different formulating of the same law of "*noncontradiction",* expressed by the formal-logical formula

$$A \wedge \overline{A} = \varnothing. \tag{22}$$

Thus, metaphysics has two laws: the first is presented either by the equality A = A, the second - by the categorical inequality $(A \neq A) = \varnothing$. Accordingly, following the laws of the *"right thinking*", we arrive at

$$\left((A = A) \wedge (A \neq A)\right) = \varnothing. \tag{23}$$

The radius-vector **r**(*t*), as the vector function, takes the variable quantitative values and simultaneously its logical structure is invariable, i.e., qualitatively it is a constant; therefore, we have

$$\left(\mathbf{r}(t) = \mathbf{r}(t)\right)_k \wedge \left(\mathbf{r}(t) \neq \mathbf{r}(t)\right)_q , \qquad (24)$$

where the subscripts *k* and *q* denote, correspondingly, the qualitative and quantitative sides of comparison, which are indivisible.

4. Conclusion

Dialectics operates with general achievements of humankind. They have been developed by many generations of scientists for centuries, and possibilities of dialectics cannot be compared with rather simplified rules of Aristotle's formal logic.

Contemporary physics recognizes formal logic, the logic of either only **Yes** or only **No**. Therefore, it is unable to overcome its one-sided plane view at the World, resulted in the restraining of the development of physics. Nevertheless, contemporary physics, because of the necessity, is forced in some cases to operate with the dialectical law of affirmation-negation, which reflects the objective regularities in nature. However, basing on the formal logic, but not dialectics, physics (being non dialectical) do it in the implicit, and the extremely cut off form. It mentions discontinuity (**Yes**) and continuity (**No**), particles (**Yes**) and antiparticles (**No**), symmetry (**Yes**) and asymmetry (**No**), rectilinear (**Yes**) and curvilinear (**No**), *etc*.

This is why, following Einstein, contemporary physics states that *only relative motion exists*, but at the same time it operates with the absolute speed of electro-magnetic waves, the speed of light, which is the same "*for all observers in uniform relative motion, independently of the relative motions of sources and detectors*". If we use the accurate language of logic, this assertion means that physics simultaneously implicitly operates with the absolute motion of electro-magnetic waves and with their absolute speed, since their absoluteness means their independence of a system of coordinates.

In the dialectical model, the aforementioned logical manipulations are not required, because the property of motion **Yes** = "**relative**" responds to its symmetrical property **No** = "**absolute**". It means that any motion in the World is a complicated symmetrical complex of absolute-relative motion, *i.e*., of motion **Yes-No**, in which the law of conservation and transformation of absolute-relative motion is valid

One can present many other examples that justify the limiting possibilities and unsuccessfulness of formal logic. Conceptual unfoundedness of an introduction in quantum mechanics of the notion *hybridization of atomic orbitals* [1], which have led in particular to the development of quantum chemistry, is also a result of such formal logical one-sided view. Let us say some words on this subject.

Conjugate potential-kinetic parameters give the complete description of physical fields [2]. The dialectical image of a judgment $\hat{\Psi}$, $\hat{\Psi} = \Psi_p + i\Psi_k$, of the general binary structure of **Yes-No,** reproduces mathematically the real image and binary character of the original. The letter *i* (imaginary unit) in the equation designates the unit of negation [3], *i.e*., points out the qualitatively opposite property Ψ_k (kinetic) with respect to Ψ_p (potential).

A misunderstanding of the latter gave rise to a nothing-grounded interpretation of the wave Ψ function in quantum and wave mechanics, according to which the real physical sense has only its modulus squared. Actually, since Max Born introduced the probabilistic interpretation of the wave function [4], till now the 'imaginary' parts, regarded as unreal quantities, do not have a firm physical interpretation. Let us cite Born's explanation: "*The reason for taking the square of the modulus is that the wave function itself* (*because of the imaginary coefficient of the time derivative in the differential equation*) *is a complex quantity, while quantities susceptible of physical interpretation must of course be real*" [4, p.142].

In reality, as proved by all experience of physics, '*real*' and '*imaginary*' parts of complex wave functions are both real. They represent two *qualitatively different* entities, in particular, the *potential* and *kinetic* features of the wave process described by the functions. We will explain this issue in more detail by analyzing harmonic oscillations of a material point.

References

[1] G. P. Shpenkov, *Conceptual Unfoundedness of Hybridization and the Nature of the Spherical Harmonics*, Hadronic Journal, Vol. 29. No. 4, p. 455, (2006).

[2] G. Shpenkov and L. Kreidik, *Conjugated Parameters of Physical Processes and Physical Time*, Physics Essays, Vol. 15, No. 3, 339-349, (2002).

[3]G. Shpenkov and L. Kreidik, *Discrete Configuration of Probability of Occurrence of Events in Wave Spaces*, Apeiron, Vol. 9, No. 4, 91-102, (2002);

http://redshift.vif.com/JournalFiles/V09NO4PDF/V09N4shp.pdf

[4] Max Born, *Atomic Physics*, Blackie & Son Limited, London-Glasgow, seventh edition, 1963; Mir, Moscow, 1965.

Lecture 4

Conjugate Parameters of Dialectical Physics

1. Introduction

For the description of the *opposite* properties of objective reality it is convenient to use *complex numbers*, as the numbers with polar opposite algebraic properties [1 -3]. The transformation of the kinetic field into the potential one, or the *electric* field into the *magnetic* one, means (in the language of complex numbers) the transformation of the "*real*" numerical field into the "*imaginary*" one, and vice versa.

Thus, as follows from the basic law of dialectics *Yes-No* (the law of symmetry and asymmetry *Yes* and *No* of the polar judgments), *motion-rest must be described by the conjugate symmetrical parameters*. Disregard of the law leads, to put it mildly, to disagreeable consequences for science (see, e.g., [4])

Correspondingly, the *kinetic speed* (the first time derivative of *kinetic displacement*) as the speed characterizing the process of motion must be conjugate with the *potential speed* (the first time derivative of *potential displacement*) as the speed characterizing the state of rest. This supposes the supplementation of the *kinetic momentum* with the *potential momentum*. We must operate also with the *potential* and *kinetic force* and *potential* and *kinetic work*, along with the *potential* and *kinetic energies* – the already-existing conjugate parameters in

physics. Contemporary physics did not develop the notion of the *potential-kinetic wave field*, which could be regarded as a generalized image of any real physical field (gravitational and electromagnetic, first of all).

It is natural that the above problems also concern the description of the *field of physical (real) time* related to an *ideal field-space* of the Universe. The notion of physical time enters in the triad of *matter-space-time* and differs from the *reference* (mathematical) *time* used everywhere.

We proceed now to consider the aforesaid missing conjugate notions (parameters) for harmonic oscillations of a material point, because these parameters have the universal character and applied to any wave process.

2. Parameters of motion-rest

2.1. *Displacement*

In dialectical logic and philosophy, consequently, in physics as well, the judgment *Yes* is the qualitative measure of affirmation, as such. Concerning its quantitative measure, the last is defined by the measures of studying processes and objects. The implicit dialectical symbol *Yes* is represented by the symbol of the physical quantity, which the symbol *Yes* expresses logically.

Since properties of the processes and objects, expressed by the judgment *Yes*, in a general case are variable ones, the dialectical judgment *Yes* is a variable quantity, represented by a function of its arguments. For example, if *Yes* expresses some displacement of a material point, then the value *Yes* is equal to the value of the displacement itself. Let a kinetic displacement of a material point *Yes* be its displacement from the state of equilibrium and defined as

$$Yes = a\cos\omega t\,. \qquad (1)$$

Following the requirement of symmetry, conditioned by the dialectical law *Yes-No,* one should introduce the notion that will be opposite to the notion of the *kinetic displacement*, *Yes*. It is natural to term it the *potential displacement*, *No*. The displacement *No*, as the *negation* of the kinetic displacement *Yes*, can be described by the sine function, since *sine is the negation of cosine*, just as *cosine is the negation of sine*. It is natural to accept the amplitude of the potential displacement as equal to the amplitude of the kinetic displacement. Apart from this, we will present the potential displacement, as the negation of the kinetic one by the ideal number. Thus, in the capacity of the potential displacement, we accept the following measure:

$$No = ia\sin\omega t\,. \qquad (2)$$

Both displacements, reflecting the indissoluble bond of rest and motion, constitute the *potential-kinetic displacement* $\hat{\Psi}$, which we present in the following form:

$$\hat{\Psi} = Yes + No. \qquad (3)$$

If we will denote the kinetic displacement *Yes* as x_k and the potential displacement *No* as ix_p, we will obtain the following dialectical expression for the potential-kinetic displacement (Fig. 1):

$$\hat{\Psi} = x_k + ix_p \qquad \text{or} \qquad \hat{\Psi} = a\cos\omega t + ia\sin\omega t. \qquad (4)$$

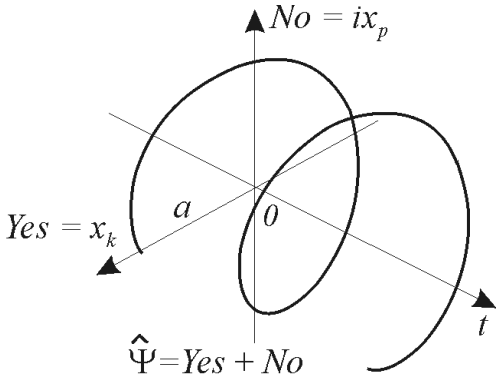

Fig. 1. A graph of the potential-kinetic displacement *Yes* – *No*.

The kinetic displacement is the possibility of the potential displacement, and, conversely, the potential displacement is the possibility of the kinetic displacement. When a material point passes through the equilibrium state, its motion is more intensive (the maximum of motion takes place). After passing equilibrium, the intensity of motion falls and, simultaneously, it increases the extent of rest, expressed through the growing value of the potential displacement. Using Euler's equations, we present the potential-kinetic harmonic displacement as

$$\hat{\Psi} = ae^{i\omega t}. \qquad (4a)$$

The constant component of the potential-kinetic displacement is expressed by the amplitude *a*, and the variable component is expressed by the ideal exponential function. The ideal exponential function $e^{i\omega t}$ is also the relative measure of displacement, and its fundamental quantum of qualitative changes is

$$e^{i\omega t} = \frac{\hat{\Psi}}{a}. \qquad (5)$$

And, because the relation (5) is valid for all harmonic potential-kinetic measures, all these measures have (in the capacity of a relative measure) the ideal exponential function. In this sense their relative measures turn out to be equal.

2.2. *Speed and acceleration*

The potential-kinetic displacement defines the potential-kinetic speed

$$\hat{\upsilon} = \frac{d\hat{\Psi}}{dt} = \upsilon_k + i\upsilon_p, \qquad (6)$$

where

$$\upsilon_k = i\omega \cdot ix_p = -\omega x_p \qquad (6a)$$

is the kinetic speed, *i.e.*, the speed of motion (the speed of kinetic displacement), and

$$i\upsilon_p = i\omega \cdot x_k \qquad (6b)$$

is the potential speed, *i.e.*, the speed of change of the state of rest (the speed of potential displacement).

Amplitude, or a module of speed, as the total speed, is the constant equal to

$$\upsilon = \omega a\,. \qquad (6c)$$

As follows from the formulas (6a) and (6b), the kinetic speed is connected with the potential displacement, whereas the potential speed is defined by the kinetic displacement.

The potential-kinetic speed defines the potential-kinetic acceleration

$$\hat{w} = \frac{d\hat{\upsilon}}{dt} = -\omega^2(x_k + ix_p) = w_k + iw_p, \qquad (7)$$

where

$$w_k = -\omega^2 x_k \qquad (7a)$$

is the kinetic acceleration, *i.e.*, the speed of change of the kinetic speed, and

$$iw_p = -\omega^2 \cdot ix_p \qquad (7b)$$

is the potential acceleration, *i.e.*, the speed of change of the potential speed.

2.3. *State*

In the potential-kinetic field, a displacement $\hat{\Psi}$ characterizes a *potential-kinetic state* $\hat{S}$ *of a material point*. We define this state through the product of its mass and the displacement:

$$\hat{S} = m\hat{\Psi} = s_k + is_p\,, \tag{8}$$

where

$$s_k = mx_k \qquad \text{and} \qquad is_p = mx_p \tag{8a}$$

are, correspondingly, the *kinetic* and *potential* states of a material point in the harmonic motion.

The state of a material point $\hat{S}$ expresses the indissolubility of its mass m and displacement $\hat{\Psi}$, i.e., the *indissolubility of matter and space* (which is reflected in its writing as *matter-space*). The potential-kinetic harmonic state can also be presented in the following form:

$$\begin{aligned}\hat{S} &= me^{i\omega t}a = (m\cos\omega t + im\sin\omega t)a = \\ &= (m_k + im_p)a = \hat{m}a = s_k + is_p\,,\end{aligned} \tag{9}$$

where

$$\hat{m} = me^{i\omega t} = m_k + im_p \tag{9a}$$

is the *kinematic potential-kinetic mass* of a material point in the harmonic oscillation.

2.4. *Charge and current*

The measure of the speed of change of the potential-kinetic state of mass $\hat{m}$ in the oscillating process is called the *kinematic charge* $\hat{Q}$. According to this definition, the potential-kinetic mass $\hat{m}$ and the *kinematic potential-kinetic charge* $\hat{Q}$ are related as

$$\hat{Q} = \frac{d\hat{m}}{dt} = i\omega\hat{m} \tag{10}$$

and, modulo, as

$$q = \omega m\,.$$

The kinematic potential-kinetic charge defines the *kinematic potential-kinetic current*

$$\hat{I} = \frac{d\hat{Q}}{dt} = \frac{d^2\hat{m}}{dt^2} = i\omega\hat{Q} = -\omega^2\hat{m} \tag{11}$$

with the amplitude

$$I = \omega q = \omega^2 m\,. \qquad (11a)$$

The amplitude of kinematic current (11a) is called the *elasticity* coefficient *k*. This name relates the amplitude of kinematic current with the *biological sensation* of exchange of motion-rest. It is analogous to such terms as heat, force, and 'fluid' (once used in physics and, actually, related to the molecular level of exchanges of motion-rest). Notions of dialectical physics are the notions of exchange of matter-space and motion-rest. We denote the amplitude of the kinematic current (11a) by the symbol *k* as well.

2.5. *Momentum and force*

The potential-kinetic state $\hat{S}$ defines the field of the *potential-kinetic momentum Yes-No*:

$$\hat{P} = \frac{d\hat{S}}{dt} = m\hat{\upsilon} = m(\upsilon_k + i\upsilon_p) = p_k + ip_p\,, \qquad (12)$$

where p_k and ip_p are the kinetic and potential momenta. The momentum *Yes* is the kinetic momentum

$$p_k = m\upsilon_k = mi\omega ix_p = -m\omega x_p\,, \qquad (12a)$$

whereas the momentum *No* is the potential momentum

$$ip_p = mi\upsilon_p = mi\omega x_k\,. \qquad (12b)$$

Thus the kinetic momentum is related to the potential displacement and the potential momentum to the kinetic displacement. The field of the $\hat{P}$-momentum is *the field of motion-rest of the first level* with respect to the $\hat{S}$-state.

The field of potential-kinetic momentum defines the field of *the potential-kinetic rate of exchange of momentum* $\hat{F}$ (*force*):

$$\hat{F} = \frac{d\hat{P}}{dt} = f_k + if_p = m\hat{w} = m(w_k + iw_p) = -I\hat{\Psi}\,, \qquad (13)$$

where

$$f_k = dp_k / dt = mw_k = -kx_k = Ix_k \qquad (13a)$$

is the kinetic rate of exchange of motion, expressed by the kinetic momentum, and

$$if_p = dip_p / dt = miw_k = -kix_p = -Iix_p \qquad (13b)$$

is the potential rate of exchange of rest, defined by the potential momentum.

The rate of exchange $\hat{F}$ is the *field of motion-rest of the second level* with respect to the $\hat{S}$ state and, at the same time, it is the state of exchange, defined by the kinematic current.

2.6. ***Energy***

As follows from (13),

$$I = -\frac{\partial \hat{F}}{\partial \hat{\Psi}}, \qquad \hat{\Psi} = -\frac{\partial \hat{F}}{\partial I}. \qquad (14)$$

The integral

$$\hat{A} = -\int_0^t \hat{F} d\hat{\Psi} = \frac{I\Psi^2}{2}\Big|_0^t = \frac{I\Psi^2}{2} - \frac{I\Psi_0^2}{2} \qquad (15)$$

defines the kinematic work $\hat{A}$, and the kinematic energy $\hat{E}$ is defined by:

$$\hat{E} = \frac{I\Psi^2}{2} = \frac{k(x_k + ix_p)^2}{2} = \frac{kx_k^2}{2} - \frac{kx_p^2}{2} + ikx_k x_p. \qquad (16)$$

The first and second components of energy (16) are the *kinetic* and *potential* energies

$$E_k = \frac{p_k^2}{2m} = \frac{m\upsilon_k^2}{2} = \frac{kx_p^2}{2}, \qquad E_p = -\frac{p_p^2}{2m} = -\frac{m\upsilon_p^2}{2} = -\frac{kx_k^2}{2}. \qquad (16a)$$

The third component is the sum of *potential-kinetic* and *kinetic-potential* energies:

$$E_{pk} = \frac{kix_p x_k}{2}, \qquad E_{kp} = \frac{kx_k ix_p}{2}. \qquad (16b)$$

Thus, following dialectics, the kinetic energy is represented by four components:

the *kinetic* energy *Yes-Yes*,

the *potential* energy *No-No*,

the *potential-kinetic* energy *No-Yes*, and

the *kinetic-potential* energy *Yes-No*.

These components logically represent the major quaternion of dialectical judgments/laws:

Yes-Yes, Yes-No, No-Yes, and No-No.

The potential displacement $ix_p = ia\sin\omega t$ defines the kinetic energy, and the kinetic displacement $x_k = a\cos\omega t$ defines the potential energy. Thus the potential displacement, as the potential displacement, is simultaneously the kinetic displacement in the sense that it defines the kinetic energy and the extremum of the state of motion. Just so, the kinetic displacement, as the kinetic displacement, is simultaneously the potential displacement in the sense that it defines the potential energy and the extremum of the state of rest.

There is direct evidence of the dialectical contradiction expressed by the law *Yes-No*. For this reason we can rename the potential displacement as the kinetic displacement and denote it as $ix_k = ia\sin\omega t$, and, similarly, the kinetic displacement as the potential displacement and denote it as $x_p = a\cos\omega t$. At such definitions of displacements the formulas of kinetic and potential displacements, speeds, and energies will take the following form:

$$\hat{\Psi} = x_p + ix_k = a\cos\omega t + ia\sin\omega t,$$

$$\upsilon_k = \frac{dx_p}{dt} = -\omega a\sin\omega t = i\omega ix_k, \qquad (17)$$

$$i\upsilon_p = \frac{dix_k}{dt} = i\omega a\cos\omega t = i\omega x_p,$$

$$E_k = \frac{p_k^2}{2m} = \frac{m\upsilon_k^2}{2} = \frac{kx_k^2}{2}, \qquad E_p = -\frac{p_p^2}{2m} = -\frac{m\upsilon_p^2}{2} = -\frac{kx_p^2}{2}.$$

As we see, it is impossible to avoid dialectics of the law *Yes-No* by changing the names of the measures into opposite ones. Now the kinetic speed of motion is the derivative of the potential displacement and, conversely, the potential speed is the derivative of the kinetic displacement. For this reason, if it is necessary to distinguish rest or motion, we will use the conjugated kinetic or potential terms.

At the *circular* motion-rest, the energy on the basis of vector measures [5] is

$$\hat{E} = \int \hat{\mathbf{F}}d\hat{\mathbf{r}} = \int m\hat{\mathbf{v}}d\hat{\mathbf{v}} = -\int I\hat{\mathbf{r}}d\hat{\mathbf{r}} = -\frac{k\hat{\mathbf{r}}^2}{2} = \frac{m\hat{\mathbf{v}}^2}{2}, \qquad (18)$$

or

$$\hat{E} = \frac{m\mathbf{v}_k^2}{2} + \frac{m\mathbf{v}_p^2}{2} + \frac{2m\mathbf{v}_k\mathbf{v}_p\cos\alpha}{2} = \\ = \frac{m\upsilon^2}{2} + \frac{m(i\upsilon)^2}{2} + \frac{2m\mathbf{v}_k\mathbf{v}_p\cos(\pi/2)}{2} = 0, \tag{19}$$

where (see Fig. 2) $\upsilon = \omega r$**,**

$$\hat{\mathbf{v}} = \frac{d\hat{\mathbf{r}}}{dt} = \hat{\mathbf{v}}_k + \hat{\mathbf{v}}_p = \upsilon\boldsymbol{\tau} + i\upsilon\mathbf{n} \tag{20}$$

or

$$\hat{\mathbf{v}} = \frac{d\hat{\mathbf{r}}}{dt} = \omega r\boldsymbol{\tau} + i\omega r\mathbf{n}\,, \tag{20a}$$

$$\hat{\mathbf{v}}_k = \frac{d\hat{\mathbf{r}}_p}{dt} = \upsilon\boldsymbol{\tau} \tag{21}$$

is the *kinetic tangential velocity*, and

$$\hat{\mathbf{v}}_p = d\hat{\mathbf{r}}_k / dt = i\upsilon\mathbf{n} \tag{22}$$

is the *potential normal velocity*.

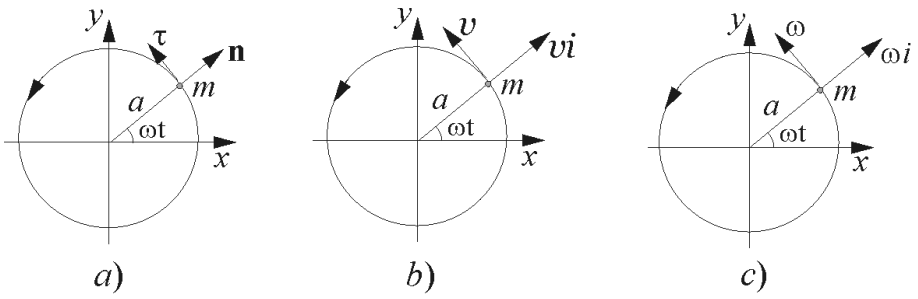

Fig. 2. The kinematics of motion-rest along a circumference: a) the tangential $\boldsymbol{\tau}$ and normal **n** units vectors; b) $\mathbf{v}_p = i\omega a\mathbf{n} = i\upsilon\mathbf{n}$ is the potential velocity, $\mathbf{v}_k = \omega a\boldsymbol{\tau} = \upsilon\boldsymbol{\tau}$ is the kinetic velocity; c) $\boldsymbol{\omega}_p = i\omega\mathbf{n}$ is the potential specific velocity, $\boldsymbol{\omega}_k = \omega\boldsymbol{\tau}$ is the kinetic specific velocity.

According to the above and the theory of oscillations of a string and the theory of circular motion [5], the energetic measures of rest and motion are represented by the opposite in sign, but equal in value, *kinetic* and *potential energies*. Because an insignificant part of an arbitrary trajectory is equivalent to a small part of a straight line, *any wave motion* of an arbitrary

microparticle (and, to an equal degree, a macro- and megaobject) *is characterized by the kinetic and potential energies*, also equal in value and opposite in sign:

$$E_k = \frac{m\upsilon_k^2}{2}, \qquad E_p = \frac{m(i\upsilon)_p^2}{2} = -\frac{m\upsilon_p^2}{2}. \tag{23}$$

Therefore the total potential-kinetic energy of any object in the Universe is equal to zero:

$$E = E_k + E_p = 0, \tag{24}$$

and its amplitude is equal to the difference in kinetic and potential energies:

$$E_m = E_k - E_p = m\upsilon^2. \tag{25}$$

Under the motion along a circumference (as in particular takes place with the electron in the H-atom), the potential-kinetic vector energy of a material point is equal to zero. By virtue of this, the circular motion is the optimal (equilibrium) state of the field of rest-motion, where 'attraction' and 'repulsion' are mutually balanced, which, in turn, provide for the steadiness of orbital motion in the micro- and macroworlds.

> The *quantitative equality* of 'attraction' and 'repulsion' is accompanied, simultaneously, by the *qualitative inequality* of the *directions* of fields of rest and motion, which generates the *eternal circular wave motion*. In order to break such a motion, it is necessary to destroy this system entirely. However, in this case, a vast number of new circular wave motions of more disperse levels will appear as a result.

The potential-kinetic parameters of oscillations considered in this Lecture have the universal character and are applied to any potential-kinetic waves of matter-space-time.

3. Conclusion

The kinetic-potential parameters of displacement, speed, acceleration, state, momentum, force, charge, and current were first introduced in physics for the description of harmonic oscillations. These (including energy) symmetrical binary potential-kinetic parameters give the more complete description of potential-kinetic fields of any nature.

The introduced parameters of oscillations have the universal character and are applied to any potential-kinetic waves of matter-space-time. At that, we should mention one result especially: it was shown that the total potential-kinetic energy of any object in the Universe is equal to zero.

The modern stage of evolution of human society suggests the mutual exchange of ideas between philosophy and physics, including mathematics as the language of physics.

Therefore, a close informal union of them is the necessary condition for the development of science at the beginning of the third millennium.

References

[1] G. Shpenkov and L. Kreidik, *Conjugated Parameters of Physical Processes and Physical Time*, Physics Essays, Vol. 15, No. 3, 339-349, (2002).

[2] G. Shpenkov and L. Kreidik, *Discrete Configuration of Probability of Occurrence of Events in Wave Spaces*, Apeiron, Vol. 9, No. 4, 91-102, (2002); http://redshift.vif.com/JournalFiles/V09NO4PDF/V09N4shp.pdf

[3] L. Kreidik and G. Shpenkov, *Material-Ideal Numerical Field*, in Contact'95, Proceedings of the General Scientific-Technological Session Contact'95, Vol.II (Bulgaria, Sofia, 1995), pp. 34-39.

[4] G. Shpenkov and L. Kreidik, "*Schrodinger's Errors of Principle"*, Galilean Electrodynamics, 3, **16**, 51-56, (2005); http://shpenkov.com/pdf/blunders.pdf

[5] L. Kreidik and G. Shpenkov, *Atomic Structure of Matter-Space*, Geo. S., Bydgoszcz, 2001, 584 p.

Lecture 5

Dialectical Field of Binary Numbers

1. Introduction

The existence of qualitatively opposite properties is the fundamental law of the Universe, and the binary field of real conjugate parameters (numbers) relevant to these properties takes that fact into account. Two diametrically opposite in sign algebras, to which two opposite components of the binary numbers obey, originate as consequence from the dialectical law of affirmation-negation for qualitatively opposite binary judgments about the nature of any object or process.

In the dialectical field of binary numbers, 'imaginary' numbers do not exist, all conjugate numbers are real, although by form dialectical binumbers are similar to common complex numbers. In particular, a wave function, called in modern physics as a "complex" function comprising real and imaginary members, in dialectical field of binumbers is considered as contained only real components, reflecting thus the potential-kinetic structure of rest-motion, and shedding light on quasi-symmetry of atomic spaces. Looking ahead further, we should note that the period of dialectical field of binary numbers at the decimal base has the fundamental meaning and equal to $\Delta=2\pi\lg e\approx 2.7288$. However, let's start everything in order.

We recall G. Leibniz's (Leibniz, G. Wilhelm, 1646-1716) well-known words:

> "*Complex numbers are a fine and wonderful refuge of the divine spirit, as if it were an amphibian of existence and nonexistence*".

And L. Euler, in his "*Algebra*" (1770), has asserted:

> "*Square roots of negative numbers are not equal to zero, are not less than zero, and are not greater than zero. From this it is clear that the square roots of negative numbers cannot be among the possible (actual, real) numbers. Hence, we have no another way except to acknowledge these numbers as impossible ones. This leads us to the notion of numbers,* ***impossible in essence****, which are usually called* ***imaginary (fictitious) numbers****, because they exist only in our imagination*."

Hitherto the situation with complex numbers in science did not change and is on the same level of non-understanding of their deep sense. This fact led to serious consequences, in particular, for the development of physics being now dominated through quantum mechanics and quantum electrodynamics. Actually, in order to get rid of the imaginary term, Born in 1926 proposed the well-known probabilistic interpretation of Schrödinger's complex wave Ψ-function [1]. Thus, the physical meaning of the wave function, because of the presence of the imaginary term, was not defined (understood), and since then quantum mechanics (QM) loudly asserts that the physical sense has only the modulus squared of Schrödinger's wave function,

$$\hat{\psi}_{n,l,m}\hat{\psi}^{*}_{n,l,m} = R^{2}_{n,l}(r)\Theta^{2}_{l,m}(\theta)\,. \qquad (1.1)$$

Looking at the squaring (1.1) and taking into account that $\hat{\psi}_{n,l,m} = R_{n,l}(r)\Theta_{l,m}(\theta)\hat{\Phi}_{m}(\varphi)$, where $\hat{\Phi}_{m}(\varphi) = e^{im\varphi}$ and $\hat{\Phi}^{*}_{m}(\varphi) = e^{-im\varphi}$, we see that the result of this action is a disappearance of the "imaginary" azimuthal function $\hat{\Phi}_{m}(\varphi)$ with its imaginary unit $i = \sqrt{-1}$. This step, consisting in throwing inconvenient functions from consideration, caused a series of the problems for QM at the description of internal structure and energetic spectra of atoms and gave rise to quantum electrodynamics (QED), which all time struggles against infinities. In spite of this, the majority of physicists, grown up on university courses on QM, is still fully convinced, e.g., of that the hydrogen atom is quite well described by Schrödinger's wave function.

Impossibility in the framework of QM to describe the spatial (volumetric) intra-atomic structure, *i.e.*, the geometry of disposition of nucleons in an atom, is also a consequence of an absolute lack of understanding the sense of the imaginary component of complex wave Ψ-function.

The absurd contradictions inherent in QM [2] (on which many have already paid attention) are a result of acceptance of the contradictory probabilistic approach. However, it is not emphasized in the literature and textbooks on QM as if it were everything all right in the theory. Therefore, note, throughout an existence of quantum mechanics, the three-dimensional distribution of extremes of Schrödinger's Ψ-functions has never been presented. Here is an example.

Actually, following the QM, the probability of the presence of a single electron in the hydrogen atom, at every point and at every instant, is proportional to the probability density $|\Psi|^{2}$.

Therefore, *e.g.*, at $l = 1$ and $m = 0$, extremes of $|\Psi|^2 = R_1^2(r)\Theta_{1,0}^2(\theta)$ (independent of φ, because $|\Phi_0(\varphi)|^2 = 1$) are in two polar points s_1 and s_2, *i.e.*, on the extreme radial sphere determined by the solutions of the radial equation for the radial function $R_1(r)$ (Fig. 1).

We arrive at the fact that with the equal probability the electron can be only either in s_1 or s_2. It means that the electron (being in the state determined by the quantum numbers $l = 1$ and $m = 0$) "hangs" above the "north" or "south" poles of the proton surface, forming together with the proton an electric dipole directed along the polar z-axis; hence, its orbital (magnetic and mechanical) moments are equal to zero.

Obviously, such a structure of the hydrogen atom, originated from the QM interpretation if we will strictly follow it, is inconsistent with experiment. The similar inconsistency is inherent in all other functions with different quantum numbers *l* and *m* that has been convincingly shown in a series of the published works (see, in particular, [2, 3]).

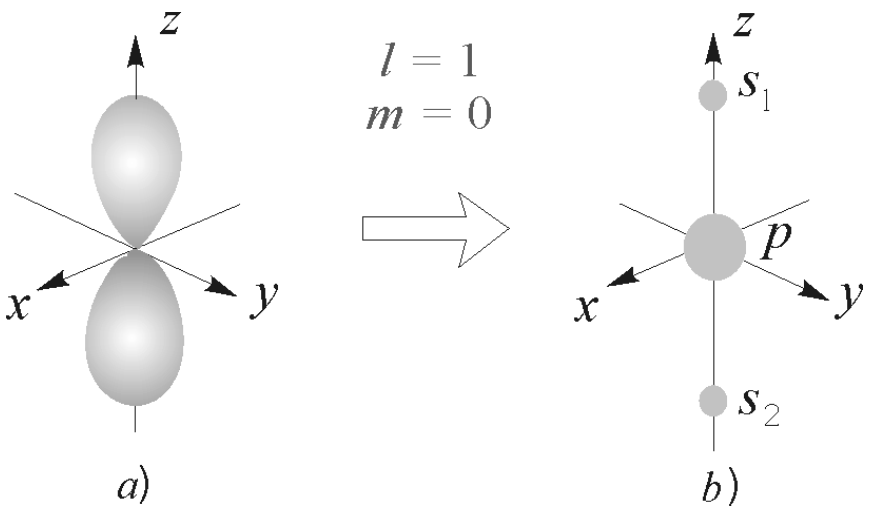

Fig. 1. The surface (a) and corresponding to it two polar extremes s_1 and s_2 (b) of the probability density $|\Psi|^2$ on the radial sphere $R_1(r)$; *p* is a symbolic designation of the nucleus-proton.

According to the postulate of existence of dialectical philosophy and logic [4], the World is material-ideal. Symbolically the material-ideal essence of the World is briefly presented by the logical binominal

$$\hat{M} = M + iR, \qquad (1.2)$$

where *M* and *iR* are, correspondingly, material and ideal components of the World; the sign "+" expresses their mutual bond, the sign "^" above *M* denotes the complexity and contradictoriness (duality) of the World.

Cognition of the World proceeds on the basis of comparison and through comparison. In the first approximation, any element of a state or a phenomenon of nature has at least two sides of the comparison. It requires describing them by the dialectical *symmetrically-asymmetric judgments* of the kind *Yes – No*. What does it mean? In dialectical logic and philosophy, consequently, also in physics, the judgment *Yes* is the qualitative measure of affirmation as such about an object or process. Concerning its quantitative measure, the dialectical judgment *Yes* is defined explicitly by the measures of the studied processes and objects. Thus, under the implicit dialectical judgment *Yes* it is implied a concrete physical quantity, which the symbol *Yes* expresses logically. The judgment *Yes – No* presents the *symmetrical* pair of judgments *Yes* and *No*, which are in essence the *opposite* judgments, so that in this sense both these judgments are *asymmetric* ones [4].

Since properties of the processes and objects, expressed by the dialectical judgment *Yes*, in a general case are variable, this judgment is also a variable quantity, represented by a function of its arguments. For example, if *Yes* expresses kinetic energy of a material point, then the value *Yes* is equal to the value of the kinetic energy.

In a general case, *Yes* and *No* are natural judgments about an object of thought. These judgments express both quantitative and qualitative notions about the object. Here are some examples of polar-opposite judgments (notions):

> *rest-motion, potential-kinetic, continuous-discontinuous, absolute-relative, existence-non-existence, material-ideal, form-contents, basis-superstructure, qualitative-quantitative, cause-effect, objective-subjective, past-future, necessary-casual, finite-infinite, real-imaginary, wave-quantum, particle-antiparticle, electric-magnetic, etc.*

For the description of qualitatively different *opposite* properties of objective reality, it is convenient to use binary numbers *similar in form* on to conventional mathematical expressions used in mathematics of *complex numbers*. But in contrast to complex numbers, dialectical binary numbers consist only of the real numbers, which have moreover, as was mentioned above, the polar opposite algebraic properties.

We intend to explain in this Lecture the main reasoning while developing the dialectical binary numerical field and to show how this problem practically was implemented by us.

Let us take, *e.g.*, the polar-opposite notions such as electric and magnetic. The transformation of the kinetic field into the potential one, or the "*electric*" field into the "*magnetic*" one, means (in the language of complex numbers) the transformation of the *material* ("*real*") numerical field into the *ideal* ("*imaginary*") one and *vice versa,* although both fields are real. However, for dialectical binary numbers, the formally complex by appearance presentation is filling up with a new meaning.

In dialectical physics, in spite of the complex in form presentation of the oppositions, both the kinetic (*electric*) and potential (*magnetic*) fields are the real fields [5], although they are qualitatively different. Accordingly, in binary numerical field, the unit *i* is not "*imaginary*", it is also the real unit. And what the meaning in reality has the unit *i* in dialectical field of binumbers,

we will show below. Thus, in the dialectical physics, we deal with the real terms (conjugate numbers) related to qualitatively different polar-opposite properties [6, 7].

2. Two opposite in sign algebras

According to dialectics, a number Z is a system of *basis B* and *superstructure* $\{S\}$:

$$Z = B^{\{S\}}. \qquad (2.1)$$

If it is necessary to underline that B is the basis of the number Z, we write $B = bas(Z)$. The superstructure $\{S\}$ represents any qualitative, quantitative, or quantitative-qualitative, symbols and/or signs characterizing the number Z with this basis.

Symbols and signs of superstructure can be settled before, after, above, and under its basis. The main signs of superstructure to basis are plus-minus signs, exponents, indexes, *etc*. We present any symbol or sign of superstructure $\{S\}$ of a number Z by the following equality

$$\{S\} = \sup_B(Z). \qquad (2.2)$$

Equality (2.2) means that '$\{S\}$ is superstructure to basis B of a number Z'.

If $Z = B^m$, then

$$m = \sup_B(Z), \qquad (2.3)$$

or, because $m = \log_B Z$, we can write also that

$$\log_B Z = \sup_B(Z) \qquad (2.3a)$$

In the simplest case, the basis of a number Z can be presented by measures *Yes* or *No*. In dialectics [4], algebra of such a basis is expressed by the following equalities:

$$Yes \cdot Yes = Yes, \quad No \cdot No = Yes, \quad Yes \cdot No = No, \quad No \cdot Yes = No. \qquad (2.4)$$

Algebra of superstructure of signs "+" and "–", expressed by the equalities

$$(\pm)\cdot(\pm) = +, \quad (\pm)\cdot(\mp) = -, \qquad (2.5)$$

is called the positive algebra of superstructure (superstructure *Yes*). Signs of superstructure *Yes*, "+" and "–", are signs of the affirmative feature.

According to dialectical logic, if algebra of signs of superstructure *Yes* (2.5) exists, then the algebra of superstructure *No*, naturally, opposite to (2.5), undoubtedly also exists:

$$(\mp)\cdot(\mp) = -\,, \qquad (\mp)\cdot(\pm) = + \qquad . \qquad (2.6)$$

Algebra of superstructure *Yes* (*algebra of affirmation*) is inherent in *longitudinal* fields, for example, describing *electric interactions*: the product of electric charges of the same sign defines repulsion and the opposite signs – attraction that is expressed by the corresponding signs "+" (repulsion) or "–" (attraction) in the right side of the equations (2.5).

On the contrary, algebra of superstructure *No* (*algebra of negation*) is inherent in *transversal* fields, which are the opposite fields (in their properties) with respect to the longitudinal fields. It describes *magnetic interactions* of currents: the product of currents of the same sign (direction) defines attraction (the sign "–") and the opposite currents – repulsion (the sign "+"). Of course, the choice of signs of a resulting interaction is relative, to some extent, but the diametric opposition of algebras of charges and currents, describing their interactions, is absolute.

> In the *longitudinal field*, it is possible to extract the square root of "+1", but impossible of "–1": $\sqrt{+1}$ exists, but $\sqrt{-1}$ does not exist.
>
> On the contrary, in *the transversal field*, it is impossible to extract the square root of "+1", but possible of "–1": $\sqrt{+1}$ does not exist, but $\sqrt{-1}$ exists.

Such are the nature of the opposite fields. In essence, in both cases, (2.5) and (2.6), we deal with the complex *longitudinal-transversal* (*e.g.*, electro-magnetic) field.

The two real units belonging to the opposite algebras of signs express their measure. Numbers pertaining to algebra of superstructure *Yes*, we call the *numbers of affirmation*, at that the unit of affirmation is denoted by the symbol of unit 1.

Any quantity of affirmation *Yes* is characterized by the number-measure Z of the kind:

$$Z = a\cdot 1 \qquad \text{or} \qquad Z = a\,, \qquad (2.7)$$

where a is an arbitrary real number of units of affirmation.

Numbers with algebra of superstructure *No*, we call the *numbers of negation*. The unit of negation is denoted by the symbols i.

Any quantity of negation *No* is defined by the number-measure Z of the kind:

$$Z = b\cdot i \qquad \text{or} \qquad Z = ib\,, \qquad (2.8)$$

where b is an arbitrary real number of units of negation.

Thus, dialectical numbers-judgments *Yes-No* can be presented by the binary structure $\hat{Z}$ of the following kind

$$\hat{Z} = a + ib\,. \qquad (2.9)$$

The sign $\wedge$ above the number $\hat{Z}$ indicates its contradictory *Yes-No* character. Obviously, both numbers *a* and *ib* are real numbers, but with the polar opposite algebras of signs.

> In this case, the factor *i* is an *indicator of the algebra of negation.*

Binary numbers of affirmation-negation $\hat{Z}$ reflect the dialectical symmetry-asymmetry inherent in nature. They form the field of binary real numbers, i.e., the field of real numbers which obey to two polar-opposite algebras in sign. We call such binary numbers as *binumbers*, and the physical parameters described by them as *biparameters*.

The *quantitative module r* of the binumber $\hat{Z}$ is defined by the equality

$$r = \left|\hat{Z}\right| = \sqrt{a^2 + b^2}\,, \qquad (2.10)$$

and the *norm* (from the Latin, *norma=quantity*) of $\hat{Z}$, $No(\hat{Z})$, is equal to the sum of *a* and *b* numbers,

$$No(\hat{Z}) = a + b\,. \qquad (2.11)$$

If one introduces the φ parameter, satisfying the equalities: $\cos\varphi = \frac{a}{r}$ and $\sin\varphi = \frac{b}{r}$, then $\hat{Z}$ (2.9) can be presented by the trigonometric function:

$$\hat{Z} = r\cos\varphi + ir\sin\varphi\,. \qquad (2.12)$$

Both components of $\hat{Z}$ can have arbitrary directions or be undirected quantities; therefore, *it is impossible, generally, to consider* the φ parameter *as an angle similarly as it takes place in complex numbers*.

As is known, any analytical function can be presented in the vicinity of a point x_0 by Taylor series. On the basis of the latter, the number $Z = e^{i\varphi}$ takes the form

$$e^{i\varphi} = \cos\varphi + i\sin\varphi\,. \qquad (2.13)$$

This equality, analogical to Euler's formula in the theory of complex numbers, makes it possible to express any binumber $\hat{Z} = a + ib$ as

$$\hat{Z} = a + ib = re^{i\varphi} = r(\cos\varphi + i\sin\varphi)\,, \qquad (2.14)$$

where the φ parameter is the *real number of units of negation of superstructure*, a phase of the binumber, expressing a variable character of the number and the bond of affirmation and negation components. Obviously,

$$tg\varphi = \frac{b}{a}, \qquad \varphi = arctg\left(\frac{b}{a}\right) \tag{2.15}$$

Because the nature of physical processes has the wave bipolar character, the wave binumerical field is able to present the structure of physical waves. If the phase plane coincides with the physical plane of oscillations and the direction of propagation of waves is perpendicular to the plane of oscillations, then the geometry of the binary field with $sup_e(\hat{Z}) = i\omega t$ coincides with the real oscillatory wave (Fig. 2) in the physical space:

$$\hat{Z} = a + bi = re^{i\omega t} = r(\cos\omega t + i\sin\omega t). \tag{2.16}$$

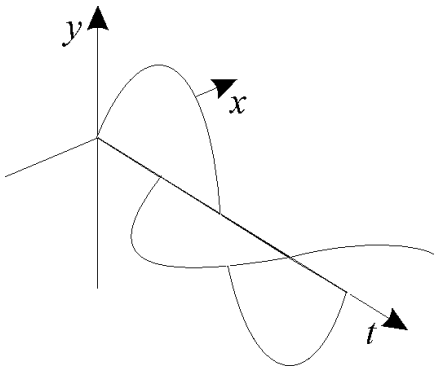

Fig. 2. A wave of affirmation-negation of binary field.

The oscillatory wave (2.16) is inseparable from the wave propagated in physical space. In particular, the simplest binary wave-beam has the following form

$$\hat{Z} = a + bi = re^{i(\omega t - ks)} = r(\cos(\omega t - ks) + i\sin(\omega t - ks)), \tag{2.17}$$

where $k = \frac{2\pi}{\lambda}$ is the wave number of the beam *s*.

If we introduce a bimodule of the number-wave (2.17), according to the equality

$$\hat{r} = re^{-iks}, \tag{2.18}$$

then the numerical biwave takes the simple form

$$\hat{Z} = \hat{r}e^{i\omega t} = \hat{r}(\cos\omega t + i\sin\omega t). \tag{2.19}$$

The latter is the elementary numerical biwave *with basis e* that defines its *fundamental period* of 2π units.

Let us turn to binumbers of the basis $B \neq e$.

The number $Z = B^{\vartheta}$ expresses *quantitative* changes if $sup_B(Z) = \vartheta$ is a number of affirmation. The number $Z = B^{i\varphi}$ describes the *qualitativ*e changes since $sup_B(Z) = i\varphi$ is a number of negation.

In a general case, a number of the kind $\hat{Z} = B^{\vartheta + i\varphi}$ represents *quantitative-qualitative* processes; and in this sense, *binumbers are quantitative-qualitative numbers.* In variable processes, $\sup_B(\hat{Z}) = \vartheta + i\varphi$ represents a parameter proportional to time, *i.e.*, $\sup_B(\hat{Z}) = (\eta + i\omega)t$. A binumber corresponding to such a superstructure is

$$\hat{Z} = B^{(\eta + i\omega)t} \tag{2.20}$$

In a case when $bas(B) = \alpha + i\beta = B_m e^{i\sigma}$, the structure of the binumber is reduced to the following quantitative-qualitative binumber,

$$\hat{Z} = B_m^{\,(-\omega\sigma + i\eta\sigma)t} \quad \text{or} \quad \hat{Z} = B_m^{\,(-\mu + i\Omega)t}. \tag{2.21}$$

Further, because

$$a^x = e^{x\gamma} = 1 + \frac{(x\gamma)^1}{1!} + \frac{(x\gamma)^2}{2!} + \ldots + \frac{(x\gamma)^n}{n!} + \ldots \tag{2.22}$$

$$a^{ix} = e^{ix\gamma} = 1 + \frac{(ix\gamma)^1}{1!} + \frac{(ix\gamma)^2}{2!} + \ldots + \frac{(ix\gamma)^n}{n!} + \ldots, \tag{2.23}$$

any binumber of the basis *B* can be reduced to the reference basis *e*. So that (2.20) can be presented as

$$\hat{Z} = B^{(\eta + i\omega)t} = (e^{\gamma})^{(\eta + i\omega)t} \tag{2.24}$$

where γ is the index of expansion of the basis *B* in terms of the basis *e*, and $\gamma = \ln B$ (that follows from the definition of the notion of logarithm).

In this case a local biwave, presented by the binumber $\hat{Z} = rB^{i\omega t}$, takes the form

$$\hat{Z} = rB^{i\omega t} = re^{\ln B \cdot i\omega t} = r(\cos(\ln B \cdot \omega t) + i\sin(\ln B \cdot \omega t)), \tag{2.25}$$

and a spatial biwave-beam of the basis *B*, $\hat{Z} = rB^{i(\omega t - ks)}$, the form

$$\hat{Z} = rB^{i(\omega t - ks)} = re^{\ln B \cdot i(\omega t - ks)} = r(\cos(\ln B \cdot \omega t) + i\sin(\ln B \cdot \omega t)), \tag{2.26}$$

where

$$\hat{r} = re^{-i\ln B \cdot ks}.$$

Additive and multiplicative algebra of binumbers of affirmation-negation, $\hat{Z}_1 = a_1 + ib_1$ and $\hat{Z}_2 = a_2 + ib_2$, is determined by the following equalities:

$$\hat{Z}_1 + \hat{Z}_2 = (a_1 + ib_1) + (a_2 + ib_2) = (a_1 + a_2) + i(b_1 + b_2), \qquad (2.27)$$

$$\hat{Z}_1 \cdot \hat{Z}_2 = (a_1 + ib_1) \cdot (a_2 + ib_2) = (a_1 a_2 - b_1 b_2) + i(a_1 b_2 + b_1 a_2), \qquad (2.28)$$

Thus, numbers of affirmation-negation $\hat{Z}$ form the field of binary *real* numbers with different algebras of signs. Components of the binary numbers reflect bipolar symmetry in nature.

3. The harmonic unit

The fundamentals of classical mathematics are constructed following the laws of formal logic, rejecting any contradictions, including the true ones. The formal (mathematical) logic operates with measures of the actual numerical field, which can be presented as

$$Z = a. \qquad (3.1)$$

Two discrete elementary judgments with the measures 1 and 0 only, about truthfulness and false of any statements, are the basis of the logic.

Judgments of dialectical logic are determined by measures of the quantitative-qualitative dialectical numerical field, reflecting dialectical contradictions; they have a general form similar, only in form, to the field of complex numbers,

$$\hat{Z} = a + ib. \qquad (3.2)$$

It should be stressed once more that both numerical fields (complex and dialectical) are different in principle, and a formal extension of the notions, axioms, and theorems of one set of the numbers to another is inadmissible.

Let us show this time the fundamental difference of two opposed (formal and dialectical) logics on the example of the logical unit. According to dialectical physics, the nature of physical processes has the wave bipolar character and is presented by the binumerical field. An elementary numerical biwave with the basis *e* has the form

$$\hat{Z} = a + bi = re^{-iks}e^{i\omega t} = \hat{r}e^{i\omega t}. \qquad (3.3)$$

where $\hat{r} = re^{-iks}$. The periodic component in (3.3), being denoted as

$$\hat{1} = e^{i\omega t} = \cos\omega t + i\sin\omega t, \qquad (3.4)$$

represents the *harmonic unit*. In the light of such a designation, Eq. (3.3) takes the following form

$$\hat{Z} = \hat{r}\hat{1} \tag{3.5}$$

The value of $\hat{Z}$ is uniquely defined by the harmonic unit, but its meaning is ambiguous, because $\hat{1}$ describes a unit wave of affirmation-negation – the rotating quantitative unit, the helix of motion (see Fig.1, L.4), *etc*.

Every state of the unit recurs many times with the period of 2π, and it is necessary to take into account qualitative changes of the unit. As different states of the harmonic unit, the units of affirmation are described by the discrete equation

$$\hat{1} = e^{i2\pi n}, \tag{3.6}$$

where *n* is the order of the unit.

As quantitative units, all the affirmative units are equal, $\hat{1} = \hat{1}$; but as qualitative ones, they are different, $\hat{1} \neq \hat{1}$. Because quantitative and qualitative features of the units are inseparable, the equality of these units by the numerical value (quantitative equality), *q*, and their qualitative inequality, *k*, characterize the units simultaneously. This is the dialectical contradiction which can be presented by the logical antinomy,

$$(\hat{1} = \hat{1})_q \wedge (\hat{1} \neq \hat{1})_k, \tag{3.7}$$

in full agreement with the "Yes-No" formula of dialectical logic. We mean the following binomial judgment,

$$(Yes = Yes) \wedge (Yes \neq Yes). \tag{3.8}$$

The equality-inequality (3.7) is consistent with the objective reality and, therefore, it is true.

In the case of two states of the unit:

$$\hat{1}_n = e^{i2\pi n} \qquad \text{and} \qquad \hat{1}_m = e^{i2\pi m}, \tag{3.9}$$

we have two relations:

$$(\hat{1}_n^p = \hat{1}_m^p)_q \wedge (\hat{1}_n^p \neq \hat{1}_m^p)_k \qquad (\text{for } p \in Z) \tag{3.10}$$

and

$$(\hat{1}_n^p \neq \hat{1}_m^p)_q \wedge (\hat{1}_n^p \neq \hat{1}_m^p)_k \qquad (\text{for } p \notin Z) \tag{3.11}$$

(Z is a set of positive and negative integer numbers). The last relation (3.11) corresponds to the dialectical formula of "No-No".

Thus, while in the field of complex numbers many functions are multi-valued, dialectical oppositions of the same design are unique. This difference is in principle. For example, a *k*-th root of the unit,

$$\sqrt[k]{\hat{1}} = e^{2\pi i \frac{n}{k}}, \qquad (3.12)$$

is unique, as one and only one root corresponds to every unit in the state *n*, and different roots correspond to different states as, for example, it takes place if we take, *e.g*., the *n* and *m* states ($n \neq m$).

The number *e* is the basis of the harmonic unit; its profound meaning deserves a special attention. We will not consider that question in these Lectures. The matter is that for revealing this puzzle, as turned out, one needed to expand the fundamental mathematical notions. Namely, modern science explicitly operates by additive continuity, which is expressed by continuously variable sums. For example, in physics, the passed distance *l* at uniform motion is the additive continuity, $l = \upsilon t$.

Continuously variable sums are described by classical differentials, derivatives, and integrals, which we call the *additive* differentials, derivatives, and integrals. On the other hand, many processes are expressed through continuously variable products by infinite products of factors of continuous series. These judgments-products express multiplicative continuity. Simplest examples of the latter are the exponential functions a^x, e^x (where *x* is a variable), and dialectical logical constructions (judgments) of the definite kind, *etc*.

Classical mathematics expresses multiplicative continuity by *additive* differentials, derivatives, and integrals. However, it is insufficient for the profound and comprehensive description of multiplicative continuity and for understanding its physical meaning. The more precise description of multiplicative continuity must be realized by *multiplicative* differentials, derivatives, and integrals. These notions were first introduced and considered in detail in [4, Vol. 1, pp. 23-55]. Here is one of the results presented in [4] concerning the basis *e* of the harmonic unit.

As follows from the indicated work, the number *e* is actually a *multiplicative derivative of a variable unit, describing the multiplicative continuity*

$$e = \lim_{\Delta 1 \to 0} \left(\frac{1 + \Delta 1}{1} \right)^{1/\Delta 1}, \qquad (3.13)$$

where $\Delta 1$ is a differential of the variable unit, $1_{var} = 1 + \Delta 1$.

In the real World, additive and multiplicative continuities are united together in the one dialectical complex, namely, in the additive-multiplicative continuity. Moreover, the additive-multiplicative continuity is inextricably linked to the additive-multiplicative discontinuity, *e.g*., such as the additive-multiplicative sharp pulse transitions.

4. Conclusion

The dialectical numerical field reflecting the bipolar symmetry and the wave character of physical processes in nature was considered in the Lecture.

For more than two thousand years, classical mathematics has been trying to construct noncontradictory theories that cannot be created in principle in the framework of formal logic. Of course, the presence of absurd contradictions in a theory is inadmissible, and in this sense any theory must be noncontradictory. However, this does not quite mean that any theory must not contain correct, dialectical contradictions. Moreover, if a theory does not contain dialectical contradictions, it is approximate and false to some extent. Dialectical binumerical field takes into account this circumstance.

Thus, it is necessary to bear in mind the undoubted fact that the World is dialectical and we should speak with it by the language of dialectical logic, the language of contradictions-noncontradictions presented mathematically by the dialectical binumerical field.

References

[1] M. Born, *Atomic Physics*, Hafner Publishing Company, New York, Seventh Edition, 1962 (First published in 1935, Great Britain).

[2] L. Kreidik and G. Shpenkov, "*Important Results of Analyzing Foundations of Quantum Mechanics"*, Galilean Electrodynamics & QED-East, Special Issues 2, **13**, 23-30, (2002); http://shpenkov.com/pdf/QM-Analysis.pdf

[3] G. Shpenkov and L. Kreidik, "*Schrodinger's Errors of Principle"*, Galilean Electrodynamics, 3, **16**, 51-56, (2005); http://shpenkov.com/pdf/blunders.pdf

[4] L. Kreidik and G. Shpenkov, *Alternative Picture of the World*, Bydgoszcz, 1996, Vol. 1-3 (148, 156, 178 p.)

[5] L. Kreidik and G. Shpenkov, *Atomic Structure of Matter-Space*, Geo. S., Bydgoszcz, 2001, 584 p. http://shpenkov.com/atom.html and http://shpenkov.com/pdf/AtomicStructureChapter8.pdf

[6] L. Kreidik and G. Shpenkov, *Material-Ideal Numerical Field*, in Contact'95, Proceedings of the General Scientific-Technological Session Contact'95, Vol. II (Bulgaria, Sofia, 1995), pp. 34-39.

[7] L.G. Kreidik and G.P. Shpenkov, *Philosophy and the Language of Dialectics and the Algebra of Dialectical Judgments*. Proceedings of The Twentieth World Congress of Philosophy, Copley Place, Boston, Massachusetts, USA, 10-16 August, 1998; http://www.bu.edu/wcp/Papers/Logi/LogiShpe.htm

Lecture 6

Law of the Decimal Base

1. Introduction

Ideal and material wave fields uninterruptedly interrelate between themselves and being tied together, exert influence on each other. This follows directly from the dialectically contradictory *material-ideal essence* of the Universe and the *wave nature* of all fields, objects, and phenomena in it. Remember that the aforesaid features are the main postulates of Dialectical Physics on which it is based and developing.

In the harmonic Universe, all objects and phenomena, their internal structure and behavior, and all fundamental parameters are obeying the law of rhythm. An influence of the latter occurs in resonance with the fundamental frequencies of the rhythm inherent in Nature. One of these frequencies is the fundamental frequency of atomic and subatomic levels, and another one is the fundamental frequency of the gravitational level of interactions in the Universe. Both from indicated frequencies, unknown earlier in physics, were for the first time discovered in the framework of Dialectical Physics.

Moreover, simultaneously, the Universe generates in people's minds a *triad of basic measures* for the surrounding space-matter being in the state of a constant ongoing movement (in the broadest sense of the word "*movement*"). Here they are: the *centimeter* – the measure of *space*, the *gram* - the measure of *matter*, and the *second* - the measure of *motion-rest*. The definite numerical values of these measures, regarded in Dialectical Physics as ideal quanta of perception of the Uuniverse, are not some random quantities. They also are in resonance with the frequency spectrum of the wave Universe.

Because all in the Universe is in natural harmony, the spectra of all said fundamental parameters and measures are closely related to the dialectical binumerical field, in particular, as was found, to the Law of Decimal Base discovered thereupon. Let us proceed to detailed consideration of this subject.

2. The fundamental quantum-period

The numerical biwave of the basis *B*, see *e.g.* (2.25) (Lecture 5), is characterized by the relative Δ and absolute Δ_t periods-quanta originated from the condition of periodicity,

$$\ln B \cdot \omega t = 2\pi m\,, \tag{2.1}$$

of harmonic functions cosine and sine, where *m* is an integer. Here they are, correspondingly:

$$\Delta = \frac{2\pi}{\ln B}, \tag{2.2}$$

$$\Delta_t = \frac{2\pi}{\ln B} \cdot \tau_t = 2\pi \frac{\lg e}{\lg B} \cdot \tau_t, \tag{2.2a}$$

where τ_t is the unit of the *t* parameter.

The nonlocal wave-beam is characterized by the same relative period-quantum, $s_\Delta = \Delta$ (Fig. 1), and the absolute spatial period-quantum $s_{\hat{\lambda}}$ equal to

$$s_{\hat{\lambda}} = \Delta \cdot \hat{\lambda}\,, \tag{2.3}$$

where $\hat{\lambda}$ is the wave radius.

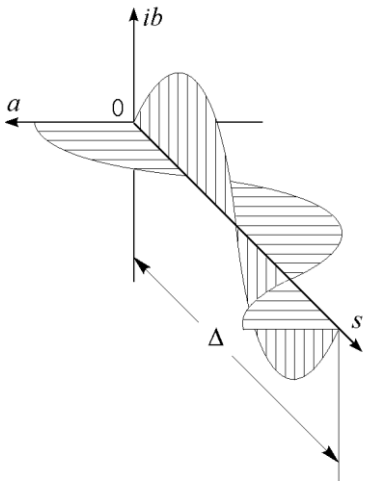

Fig. 1. A graph of a spatial numerical biwave-beam $\hat{Z}$.

Thus in the field of binary numbers, the correlation between the base of a binumber and its superstructure has the fundamental meaning. Indeed, if a physical process requires for its presentation a binary number $\hat{Z}$ with some base *B*, then its binary measure, as was shown in the previous Lecture, takes the form

$$\hat{Z} = rB^{i\varphi} = r\exp(i\ln B\cdot\varphi) = r(\cos(\ln B\cdot\varphi) + i\sin(\ln B\cdot\varphi)). \qquad (2.4)$$

When the base *B* is the number *e* – the base of natural logarithms, *i.e.*, $B = e$, then the relative period-quantum Δ of the numerical biwave (2.4) is equal to 2π:

$$\Delta = \frac{2\pi}{\ln B} = \frac{2\pi}{\ln e} = 2\pi \qquad (2.5)$$

From the point of view of dialectics the World is the material-ideal formation. Therefore, ideal processes in the Universe run their course on the basis of the informational material-ideal bifield lying in the base of the quantitative-qualitative code of the Universe.

A material facet of the Universe is described on the basis of physical laws, which we call the *first kind laws*. The laws reflecting an ideal side of the Universe relate to non-physical laws, we call them the *second kind laws*.

The numerical quantitative-qualitative wave bifield of affirmation-negation with the *fundamental basis B* and the corresponding *period* $\frac{2\pi}{\ln B}$ is one of the elementary levels of an informational (ideal) field of the Universe, where distinctive laws, the laws of the second kind act.

The symmetrical structure of human hands and foots of five fingers has prompted the choice of the *fundamental basis B*, which was accepted *equal to ten*. Thus, for the decimal base, $B = 10$, used by humankind on our Earth, we have

$$\ln B = \frac{\lg B}{\lg e} = \frac{1}{\lg e}.$$

Hence, the *fundamental* (relative and absolute) *period-quantum* of the bifield of the decimal numerical base is equal to

$$\Delta = \frac{2\pi}{\ln B} = 2\pi\frac{\lg e}{\lg 10} = 2\pi\lg e = 2.728752708... \approx 2.7288. \qquad (2.6)$$

The fundamental quantum-period (2.6) defines the quantum-period of half-wave (the wave half-period – half-quantum)

$$\Delta\left(\frac{1}{2}\right) = \pi \lg e \approx 1.3644 \qquad (2.7)$$

The fundamental period Δ reflects the Law of Decimal Base that is in essence the Decimal Code of the Universe. Human beings intuitively follow the Law of Decimal Base. The fundamental period-quantum pierces natural science and art, it reveals itself in processes of perception by men of ambient nature; it is characteristic also for music, *etc*. As turned out, the Law of Decimal Base expressed by the formula (2.6) *is in the foundation of metrology of nations* [1] because the spectrum of measures is obeying to the formula

$$M = 2^k \cdot 3^l \cdot 5^m \Delta, \qquad (2.8)$$

where $k, l, m \in Z$. This law reveals the quantum character of numerical values of fundamental physical constants and the reference units (gram, centimeter, and second). Here are some examples from metrology.

The Old English bushel of free-flowing substances, defined the unit of mass in one bushel of mass, was equal to $27.28kg \approx 10^4 \cdot \Delta\, g$. This unit was in the base of Oriental measures. The Old English pound of mass was equal at that time to 273 *g*. Five bushels of mass generated a barrel of 136.4 *kg*.

A Japanese koku of grain of 136.88 *kg*, an English tierce of meat of 137.89 *kg*, an Australian bale of wool of 136 *kg*, and numerous barrels of petroleum products are related to the same level of spectrum of measures (2.8). In Iran, a barrel is equal to 136.4 *kg*, in Brazil – 136.7 *kg*, in Bahrain Islands – 136.3 *kg*, in Kuwait – 137.8 *kg*, *etc*.

The most important *ancient Roman* unit of mass, the *ounce*, was equal to

$$27.288\ g = 10\Delta\ g.$$

In ancient Greece, the unit of volume the kotyla (cup) was equal to 10 ounces of volume, 1 kotyla = 0.27288 *l*, and 100 kotylas had determined the metret of 27.288 *l*.

The Old Russian metrological spectrum of mass is closely related to wheat grain (corn), which was called the pirog (pie). According to the historical and archeological data, this spectrum is also represented by the formula (2.8): 1 pirog = $2^{-6}\Delta\, g$, 64 pirogs = 16 pochkas (buds) = 2.7288 *g*.

By the end of the 15th century, the common Russian monetary count on the basis of a ruble had been formed: 1 ruble = 100 kopecks = 200 money =1600 pirogs = 68.22 *g* = $2^{-2} \cdot 10^2 \Delta\, g$.

The ruble and its derivatives had been used simultaneously as units of mass during the 15-17th centuries (1 kopeck = 0.6822 g = $2^{-2}\Delta\, g$).

The above presented and other numerous data, which can be found in the relevant literature on folk measures, uniquely confirm their relation to the fundamental period-quantum (2.6).

3. Decimal Code of the Universe

Adhering to the dialectical philosophy and dialectical logic, we consider the Universe as the Material-Ideal System. Accordingly, in such a system must be not only material, physical laws but also the laws of an ideal facet of the Universe, ideal laws [2-4]. We call them the Laws of the Second Kind, thereby distinguishing them from ordinary physical (material) laws, which we attribute to the Laws of the First Kind.

We continue to discuss one of the fundamental phenomena existing in the Universe, unknown up till now to "modern" physics, related to the aforementioned Second Kind Laws, to which, as we assume, all physical phenomena are subject. This is the fundamental law of nature, that we discovered, relating to one of the ideal fields (in opposite to physical) of the Universe, namely, to the dialectical numerical field [3]. Numerical fields, including the binary dialectical numerical field, are typical ideal fields of the Universe. All additional information about the binary numerical field of dialectical physics can be found, in particular, in [6-8] available online on the Internet.

Physics uses the absolute, reference, time *t*, which represents an ideal mathematical time of an imaginary absolute uniform motion. It is defined by the formula

$$t = \frac{l}{\upsilon}. \qquad (3.1)$$

The real (physical) time as a measure of pure rest-motion is determined by the similar way as it is done for the reference time (3.1) [5]. However, the displacement in the numerator of the formula of the physical time must be a complex wave function, which reflects the dual potential-kinetic nature of the movement. Take for example the wave function

$$\hat{\Psi} = \hat{R}(r)\Theta(\theta)\hat{\Phi}(\varphi)\hat{T}(t) = \hat{\varphi}(r,\theta,\varphi)\hat{T}(t). \qquad (3.2)$$

It satisfies the universal wave equation

$$\Delta\hat{\Psi} - \frac{1}{c^2}\frac{\partial^2\hat{\Psi}}{\partial t^2} = 0. \qquad (3.3)$$

This equation contains a wealth of information about the structure and behaviour of physical objects that have the wave nature, and about physical processes occurring in them in space and time [2]. From dialectical point of view, Eq. (3.3) presents, in form and content, the mathematical expression of the inseparable bond of the fields of material space with an ideal

field of the physical time. The time function $\hat{T}(t)$, its simplest form is $\hat{T}(t) = e^{\pm i\omega t}$, expresses, with use of the variable *t* of the absolute mathematical time, the physical periodical time field.

Thus, the physical time of harmonic oscillations $\hat{t}$ is defined as the ratio of the potential-kinetic displacement $\hat{\Psi}$ to the modulus of the potential-kinetic speed υ:

$$\hat{t}(t) = \frac{\hat{\Psi}}{\upsilon} = \frac{ae^{i\omega t}}{\omega a} = t_e e^{i\omega t} = t_e(\cos\omega t + i\sin\omega t), \qquad (3.4)$$

where

$$t_e = \frac{1}{\omega} = \frac{T}{2\pi} \qquad (3.5)$$

is the modulus of the potential-kinetic time. The time period is $T = 2\pi t_e$. We see that the modulus of the potential-kinetic time t_e represents the radius of a time circumference *T*.

When $t_e = 1$, we come to a unit (absolute) time radius. Hence, when the basis of binumbers is the number *e*, *i.e.*, the base of natural logarithms, the absolute time period, corresponding to the unit time radius t_e, is $T = 2\pi$. In this case Eq. (3.4) takes the form,

$$\hat{t}(t) = \hat{1}_e(t) = e^{i\omega t} = \cos\omega t + i\sin\omega t. \qquad (3.6)$$

The lower index indicates the unit base *e*, in which all parameters are presented (usually it is omitted). Thus, we have a time circle $T_e = 2\pi$ with a time radius (vector) of the unit length, $t_e = 1$, uniformly rotating with the absolute time angular velocity $\omega_e = 1$.

The above presented absolute parameters of time (t_e, T_e, and ω_e) are zero-dimensional measures, so they are universal, common to all minds on any planetary system in the Universe (regardless of the time measurement methods taken there).

An appearance of the concept of time is equally and inevitable everywhere in the Universe. It is connected with the circular motion of the planets in stellar systems and, consequently, due to cyclic processes in them resulting in the fully-formed proper biological rhythm of their reasonable creatures. Let us remember in this regard the first sundials of our distant ancestors. The operating principle of the most widespread of them is clear seen on an example of the sun clock shown in Fig. 2.

In the transition from the base of natural logarithms *e* to an arbitrary basis *B* (*e.g.*, octal or decimal, *etc*.), the absolute radius of the unit time is saved, that is,

$$t_B = t_e = 1, \qquad (3.7)$$

and, respectively,

$$\hat{1}_B(t) = \hat{1}_e(t). \qquad (3.8)$$

Fig. 2. A solar clock.

In the base *e*, see (3.6), $\hat{1}_e(t) = e^{i\omega t}$. But in the base *B*, a time radius (vector) of the unit length of $t_B = 1$, is

$$\hat{1}_B(t) = B^{i\omega_B t}, \tag{3.9}$$

Thus, at any basis *B*, we have the equality

$$B^{i\omega_B t} = e^{i\omega t}, \tag{3.10}$$

where ω_B is the absolute time angular velocity in an arbitrary basis *B*. The following elementary mathematical relations are valid for Eq. (3.10):

$$i\omega_B t \ln B = i\omega t, \qquad \text{or} \qquad \frac{i\omega_B t}{\log_B e} = i\omega t. \tag{3.11}$$

Considering (3.6) - (3.11), the rotation of the unit time vector (3.6) in an arbitrary basis *B* takes the following general form:

$$\hat{1}_B(t) = e^{\frac{i\omega_B t}{\log_B e}} = \cos\left(\frac{\omega_B t}{\log_B e}\right) + i\sin\left(\frac{\omega_B t}{\log_B e}\right). \tag{3.12}$$

Here ω_{10} is the absolute time angular velocity in the decimal basis.

For the particular case of the decimal basis, $B = 10$, substituting this particular parameter in (3.12), we arrive at the following expression:

$$\hat{1}_B(t) = 10^{i\omega_{10} t} = e^{\frac{i\omega_{10} t}{\lg e}} = \cos\left(\frac{\omega_{10} t}{\lg e}\right) + i\sin\left(\frac{\omega_{10} t}{\lg e}\right). \tag{3.13}$$

The period T of the exponential function (3.6), $e^{i\omega t} = \cos\omega t + i\sin\omega t$, is equal to 2π, *i.e.*,

$$T_e = \omega_e t = 2\pi .$$

The period of the exponential function $e^{\frac{i\omega_{10}t}{\lg e}}$ (3.13) (as any exponential function with the base e) is equal to 2π as well, *i.e.*,

$$T_e = \frac{\omega_{10}t}{\lg e} = \frac{T_{10}}{\lg e} = 2\pi . \qquad (3.14)$$

Hence, the unit time circles in the two bases, $B = 10$ and $B = e = 2.71828...$, are related by the following equality,

$$T_{10} = \omega_{10}t = T_e \lg e . \qquad (3.15)$$

Because $T_e = 2\pi$, we have

$$T_{10} = \omega_{10}t = 2\pi \lg e . \qquad (3.15a)$$

Thus, we have arrived at the *absolute period of the absolute time at the decimal base.* Denoting T_{10} by the symbol Δ, we will write this result in the form,

$$\Delta = 2\pi \lg e = 2.7287527... \qquad (3.16)$$

> This quantity represents the *fundamental period-quantum of an ideal field of the decimal numerical base*.

The dominant number system on the Earth is the decimal numeration. The emergence of this system was not accidental. As it turned out, the decimal basis underlies the cosmic processes. In particular, it determines the stability of oscillatory (wave) motion of the Earth in the Solar System, including the Earth-Moon system. Let us show this. If one takes one day as the unit of time, then the rotational period of the Moon around the Earth, equal to 27.3 days, is tenfold of the absolute time period of the decimal base, *i.e.*, 10Δ. And the time wave radius of the Moon's orbit,

$$ƛ_{Moon} = \frac{< r_{Earth–Moon} >}{\upsilon} \approx 4.34\ days , \qquad (3.17)$$

is tenfold of the absolute time radius equal to $\lg e = 0.43429448...$ The value in brackets $< r_{Earth–Moon} > = 384.467\ kkm$ is an average distance between the centers of the Earth and Moon; an average orbital speed of the Moon is $\upsilon = 1.023\ \ km \times s^{-1}$. If one takes 10 Earth days for a unit of time, then the period of revolution and the time radius of the Moon's orbit will be equal, respectively, to the numerical values of Δ and $\lg e$. Thus, we can say that the Earth-

Moon system is in resonance with the period-quantum Δ of the Decimal Code of the Universe, and therefore such a system is stable. We should remind, in this regard, that the phenomenon of the unique stability, in general, of the moving systems bound by circular motion was considered earlier in Lecture 4.

The time angular speed of the proper time wave field of the Earth, corresponding to the sidereal day: 23 hours, 56 minutes, 4 seconds is equal to $\omega_{Earth} = 7.2939 \times 10^{-5}\ s^{-1}$. From this it follows that the time radial wave of the Earth's rotation around its axis is multiple of half the fundamental period-quantum, $\frac{1}{2}\Delta$, of an ideal field of the decimal numerical basis:

$$\lambda\!\!\!^{-}_{Earth} = \frac{1}{\omega_{Earth}} \approx 1.37 \times 10^{4}\ s\,. \qquad (3.18)$$

The frequency of rotation of the Earth around the Sun is also in harmony with the absolute period-quantum (3.16):

$$\nu = \frac{1}{T} = \frac{1}{365.26} \approx 2.74 \times 10^{-3}\ \ days^{-1}. \qquad (3.19)$$

Let us look at the Universal harmony from another side. From the Dynamic Model (DM) [9, 10] it follows that the gravitational field is wave [11, 12], and its fundamental frequency is equal to

$$\omega_g = 9.158082264 \times 10^{-4}\ s^{-1}. \qquad (3.20)$$

The gravitational interaction of all material objects in the Universe is carried out on this frequency.

The gravitational frequency (3.20) defines the *radial* time wave-period,

$$T_g = \frac{2\pi}{\omega_g} = 0.686080898 \times 10^{4}\ s\,. \qquad (3.21)$$

We know that only one half-wave of the fundamental tone is placed on an orbit. The standing half-wave forms in a circular orbit a single wave node. Hence, the following, in value, *azimuthal* time wave of the fundamental tone corresponds to the radial wave period (3.21),

$$T_{azimuth} = 4\pi T_g = 8.621546841 \times 10^{4}\ s\,. \qquad (3.22)$$

This value almost coincides with the sidereal day of

$$23\ hours, 56\ min, 4\ s = 8.6164 \times 10^{4}\ s\,. \qquad (3.23)$$

Note that the time wave, $T_{azimuth} = 4\pi T_g$, repeats the structure of the spatial wave of the fundamental tone on the Bohr orbit of the hydrogen atom, $\lambda = 4\pi r_0$ [2].

The above relations show that the Earth is in harmonic resonance coupling with both the fundamental period-quantum Δ of an ideal field of the decimal numerical basis and the fundamental frequency of the gravitational field ω_g. Like the electron in the Bohr orbit in the hydrogen atom is in harmonic resonance coupling with the period-quantum Δ and the fundamental frequency of the atomic and subatomic levels ω_e.

Thus, the Earth is fundamentally different from other planets of the Solar System. For this reason it occupies a special place in the system. Similarly the hydrogen atom is fundamentally different from other elements of the Periodic Table.

Our analysis showed that at the heart of the ancient spectrum of measures of various nations at the dawn of our civilization lies the fundamental period-quantum Δ of an ideal field of the decimal numerical basis (3.16). The decimal system penetrated into the life on the Earth independently and everywhere under the influence of cosmos.

With the development of our civilization to the present day, a lot has changed; with this the new measures have emerged and old ones were changing. However, some of them related to the fundamental period-quantum have survived to this day almost unchanged. This subject was described in detail in [2-4, 8]. I cite here below (additionally to that measures presented above in previous Sect. 2) only a few examples from the recent past and the present time, demonstrating the relationship of various measures with the fundamental period-quantum $\Delta = 2.72875\ldots$ of an ideal numerical field (with accuracy up to an order of magnitude). Here they are.

Ancient Roman ounce = 27.2875 *g*
A measure of tea (UK), bag of tea (cybik, from Russian“цыбик”) = 27.2 *kg*
A measure of flax yarn (UK), lea = 274.31 *m*
A measure for wheat (U.S., UK), board pound = 27,216 *kg*
A measure for potatoes (U.S.), board pound = 27.216 *kg*
Barrel of rice (U.S.) = 272.2 *kg*
A measure in weighing silk in Russia (14-17 cc), ansyr = 545.28 *g* (272.64×2)
Thaler Milan coin (1556-1598), filippo = 27.5 *g*
Bale of paper (U.S.) = 136.0 *kg* (272.0 : 2)
Bale of cotton (U.S.) = 170.0 *kg* (the golden section of 272.875...)
Bulgarian sartorial arshin = 68 *cm* $(272.0 : 4)$
Net weight of 2.5 pounds explosive charges M5A1 (U.S.) in a box = 27,216 *kg*
Barrel of mineral oil (U.S.) ≈ 136.4 *kg* (272.8 : 2)
Barrel for the measurement of cranberries (U.S.) = 2.71 bushels

Interesting evidence, which has come down to us from prehistoric times, is contained in the document written in French of about hundred and fifty years ago, with which the members of the expedition in Burma [13, p. 105] were lucky to meet. Here is a fragment of the text (translated from Russian).

> «*...An entrance to the cave represents a small cutout of an arcuate shape on the east side of the hill. Immediately after the entrance, literally at a depth of five meters, there is a very spacious hall with a relatively small lake located at its center, and on the opposite wall with respect to the entrance, on the other side of the lake, there is a heathen temple; along the entire wall lined up strictly in line* 9 (*nine*) *of mineral columns of equal height* (54 *cm*) *and the same diameter* (27 *cm at its base and* 17 *cm at the top*). *...columns were not liable to exposure by mechanical tools, showing a pattern of durability... After that, the cave was blown up, so the hill where the cave was located was completely destroyed*»*.... "In those few years of French occupation in the nineteenth century, this cave was blocked and completely destroyed. Why? The French wanted to nullify the native beliefs of the Burmese, and the cave just such fundamental beliefs has cultivated. Since ancient times, rites of worship of spirits, in the reality of which no one could doubt, were accomplished in it...*».

Ordained monks from nearby monasteries were told that in the cave, which was completely destroyed by the French about 150 years ago, "*was an ancient temple, left over from atlanteans*" [13, p. 175]. Please, pay attention to the numbers 9 , 54, 27, and 17, which are multiple to Δ (3.16) (with accuracy up to an order of magnitude):

> The number 9, (27:3), is related to identical columns of a mineral in the form of a truncated cone of the 54 *cm* height, (27×2), and of the 27 *cm* diameter from the bottom and 17 *cm* on top. The number 1.7 is multiple to $\sim \frac{5}{8}\Delta$, that is, a golden section of the fundamental period-quantum.

6. Conclusion

The Universe is a single *material-ideal wave system*, where the material and ideal components of the system are inseparable, interacting and influencing each other. Therefore, regardless of the will and consciousness of people, *ideal fields* (in particular, an ideal field of the decimal numerical basis) naturally exert influence upon the physical fields and the wave structure of *material* objects. This is evident everywhere, and in particular, as we have found, in the spectrum of measures, shown here, and the numerical values of the fundamental physical constants [14]. The latter subject is presented as Supplement to the book “Some words about fundamental problems of physics” [15] and accessible online on Internet.

Thus, everything in the Universe is in natural harmony and at all levels is strictly subordinated to a certain rhythm. Owing to this, the frequency spectrum of oscillatory-wave processes in Nature correlates with the fundamental period-quantum Δ of an ideal field of the decimal numerical basis.

REFERENCES

[1] L. Kreidik and G. Shpenkov, *Alternative Picture of the World*, Bydgoszcz, 1996, Vol. 1-3 (148, 156, 178 p.)

[2] L. Kreidik and G. Shpenkov, *Atomic Structure of Matter-Space*, Geo. S., Bydgoszcz, 2001, 584 p. http://shpenkov.com/atom.html and http://shpenkov.com/pdf/AtomicStructureChapter8.pdf

[3] L. G. Kreidik and G. P. Shpenkov, *Alternative Picture of the World*, Geo. S., Bydgoszcz, 1996. Vol. 1: Mathematical Expression of the Main Categories of Philosophy and Logic, Kinematics and Dynamics of Exchange; 158 p. http://shpenkov.com/Alt.html

[4] L.G. Kreidik and G.P. Shpenkov, *Foundation of Physics*: *13.644... Collected Papers*, Geo. S., Bydgoszcz, 1998, 258 p.; http://shpenkov.com/Found.html

[5] G. P. Shpenkov and L. G. Kreidik, *Conjugated Parameters of Physical Processes and Physical Time*, PHYSICS ESSAYS, Vol. 15, No. 3, (2002); http://shpenkov.com/pdf/ConjugateParameters.pdf

[6] L.G. Kreidik and G.P. Shpenkov, *Philosophy and the Language of Dialectics and the Algebra of Dialectical Judgments*. Proceedings of The Twentieth World Congress of Philosophy, Copley Place, Boston, Massachusetts, USA, 10-16 August, 1998; http://www.bu.edu/wcp/Papers/Logi/LogiShpe.htm

[7] L.G. Kreidik and G.P. Shpenkov, *Description of Physical Processes by the Dialectical Field of Binumbers*. The paper No. 3, in "*Foundation of Physics: 13.644... Collected Papers*", pp. 37-52, Bydgoszcz, 1998; http://shpenkov.com/pdf/Binumbers.pdf

[8] L.G. Kreidik and G.P. Shpenkov, *Interrelation of Values of Base Units and Fundamental Constants with the Fundamental Quantum of Measures*. The paper No. 4 in "*Foundation of Physics: 13.644... Collected Papers*", pp. 55-68, Bydgoszcz, 1998; http://shpenkov.com/pdf/Metrology.pdf

[9] L. G. Kreidik and G. P. Shpenkov, *Dynamic Model of Elementary Particles and the Nature of Mass and "Electric" Charge*, REVISTA CIENCIAS EXATAS E NATURAIS, Vol. 3, No 2, 157-170, (2001); https://revistas.unicentro.br/index.php/RECEN/article/view/478

[10] G. P. Shpenkov, *Theoretical Basis and Proofs of the Existence of Atom Background Radiation*, Infinite Energy, Vol. 12, Issue 68, 22-33, (2006);

http://shpenkov.com/pdf/TheorBasis.pdf

[11] G. P. Shpenkov, *The Wave Nature of Gravitational Fields: General Characteristics* (2007); http://shpenkov.com/pdf/Gravitation.pdf

[12] G. P. Shpenkov, *The Nature of Gravitation: a New Insight*. A PowerPoint presentation prepared for the 19th International Conference on General Relativity and Gravitation, 5-9 July, 2010 Mexico City; http://shpenkov.com/pdf/A1-36-GR19-2010.pdf

[13] R. Blavo and M. Messing, *The Secret Doctrine of Atlanteans and Lemurians* (in Russian, based on the Rushel Blavo expedition to Burma). St. Petersburg: Publishing house «Vedy», 2009, 192 p

[14]. George Shpenkov, SOME WORDS ABOUT FUNDAMENTAL PROBLEMS OF PHYSICS, LAP LAMBERT Academic Publishing, pages 128, 2012;
shpenkov.com/pdf/Book-2011-Eng.pdf
amazon.com/words-about-fundamental-problems-physics/dp/3659237507

[15] G. Shpenkov, *Fundamental Period-Quantum of the Decimal Code of the Universe and Fundamental Physical Constants*; http://shpenkov.com/pdf/Period-Quantum-Eng.pdf

Lecture 7

Meaning of the Unit "*i*"

1. The principle of complementability of notions

Dialectics of the field of binary numbers of the structure (see (2.9), L. 5),

$$\hat{Z} = a + ib \,,$$

requires realization of the *principle of complementability of notions*. If there is the notion defined by the component of *affirmation* (*a*) and there is not the notion corresponding to the component of *negation* (*ib*), hence, it is necessary to introduce the lacking complementary notion. Following this way, we will arrive at the complete description of a studying phenomenon.

We see, and it was discussed in previous Lectures, that algebra of binary numbers of dialectics coincides *formally* with the algebra of complex numbers [1] consisting of '*real*' and '*imaginary*'(unreal) components, *a* and *ib*, correspondingly. Then the question arises. What is the difference in substance between aforesaid sets of numbers, in principle?

In the case of dialectical field of binumbers, dialectical measures of *affirmative meaning* related to the field of *material* states are naturally represented by a set of real numbers *R* and called *material* (or *real*) *numbers*, *a*; whereas, the measures of *negation meaning* related to the field of *ideal* states of the *material-ideal* Universe are represented by a set of *negation*

numbers, ib. These numbers *are real too*, however, for distinguishing them from *material* (or *real*) *numbers, a*, we call the real *ib* numbers *ideal numbers* (as against unreal *imaginary numbers ib* used in mathematics of complex numbers), while stressing thus their belonging to an *ideal* component (component of negation) of the binumerical field.

In this connection, for definiteness, we attribute the measures of *possibility*, *future*, *rest*, and *ideal states* of processes and phenomena (which are *polar-opposite* notions, correspondingly, to the notions: *reality*, *past*, *motion*, and *material states*) to the field of *ideal numbers*. Two qualitatively different – *polar-opposite algebras of signs* inherent in the field of polar-opposite numbers, *material* and *ideal*, are used therewith.

If the logical judgment *Yes* expresses *reality* and *No* – *possibility*, then measures *Yes* must be expressed on the basis of the *field of real numbers*, and measures *No* – on the basis of the *field of ideal numbers*. That gives us an accurate dialectical description of different conjugate processes (*e.g.*, related to such opposite notions as: *possible* and *real*, *potential* and *kinetic*, *electric* and *magnetic*, *past* and *future*, *material* and ideal, *etc*.).

The world is a *material-ideal* (quantitative-qualitative) *real system*. Hence, the *material unit* 1 and the *ideal unit* $\dot{1}$ (designated as *i*, $\dot{1} \equiv i$) are both the *real units* as well, related, respectively, to *material* and *ideal* (quantitative and qualitative) constituents of the system. The dot above the unit, $\dot{1}$, indicates on obeying this unit to the algebra of negation. *Material numbers* conform to the algebras of *affirmation*, and *ideal numbers* – to the algebra of *negation*.

The essential difference in the underlying meanings of the numbers written equally as *ib* in both aforementioned cases (we mean *complex numbers* and *dialectical binumbers*) has been, thus, more than once explained and, one can hope, convincingly enough clarified. Therefore, we can proceed now to consideration of some concrete applications.

2. A first example: an equation $y = x^2$

Let us show the definite relativity of the notions, '*real*' and '*imaginary*', from the point of view of dialectics, with an analysis of the solutions for the equation $y = x^2$ regarded in modern mathematics as an elementary equation of a parabola.

A dialectical analysis of the equation $y = x^2$ has revealed its binary structure (Fig. 1) and showed how the dialectical logic, which is the basis of the binumerical field obeying two conjugate algebras of signs, works. We see that an upper parabola ("*Re*") represents only a half of the complete solution. This example evidently manifests the pair symmetry existing in Nature.

There are no problems with the finding of the value of the argument *x* if $y = +b^2$. There is no problem so long as $+b^2 > 0$. The square root gives the true values *x*:

$$x = \sqrt{+b^2} = \pm b . \qquad (1)$$

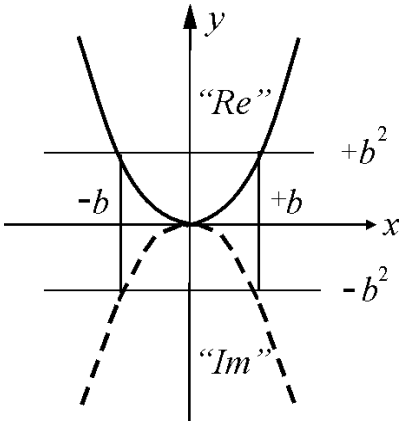

Fig. 1. The symmetrical, '*real*' (*Re*) and '*imaginary*' (*Im*), branches of a parabola.

Now, let us imagine a situation when, because of some conditions, we arrive at the equality $y = -b^2$. In this case, we have

$$x = \sqrt{-b^2} = \pm ib. \qquad (2)$$

In the framework of common notions about complex numbers, it is impossible to show the values of the argument *x* (2) in a diagram, because *i* is the '*imaginary*' (*fictitious*) unit (remember Lecture 5).

Following the dialectical binary structure of numerical fields, we obtain

$$x = \sqrt{-b^2} = \pm \dot{1}b. \qquad (3)$$

Because $\dot{1}$ is the real unit in the dialectical binumerical field, the solution (3) means that we have obtained two real values of the argument *x*: $+\dot{1}b$ and $-\dot{1}b$. They define the missing part of the biparabola (which the equation $y = x^2$ represents, as it turned out, in reality) denoted conditionally as "*Im*" (a dash line in Fig. 1). The missing (non-existent in contemporary mathematics) parabola is conjugate and symmetrical to the parabola denoted by the symbol "*Re*".

Following the fully-formed modern concepts, the equation $y = x^2$ describes a parabola depicted in Fig. 1 above the *x*-axis. However, mathematics based on dialectical logic and concrete physical conditions does "know" nothing about the aforesaid solution. It depicts the whole plot corresponding to the complete solutions of the equation, highlighting graphically dialectically contradictory character of the equation.

Thus, solutions of the equation $y = x^2$ give at the *x*-axis, apart from the real values $+b$ and $-b$, the real values $+\dot{1}b$ and $-\dot{1}b$. Note again, the last pair of values is subjected to the negative algebra of signs (see (2.6) in L. 5) in opposition to the first one with the positive algebra of signs

(see (2.5) in L. 5). If we change the positive direction of the *y*-axis, then the 'real' branch of parabola is turned out to be 'imaginary' and 'imaginary' – 'real'.

The world is a system of contradictions *Yes* and *No*, which always coexist. It is the principal axiom of dialectical philosophy − the philosophy of the symmetrical world with the definite asymmetry of its opposite parts. In this connection, it is to the point to cite here, for example, the outstanding Chinese philosopher Chuang Tzu (c. 369-286 B.C.) who has written [2] (p.215):):

> "In the World, everything *denies* itself through the other thing, which is its opposition. Every thing states itself through itself. It is impossible to discern (in the one separately taken thing) its opposition, because it is possible to perceive a thing only immediately. This is why, they say: '*Negation* issues from *affirmation* and affirmation exist only owing to negation'. Such is the doctrine on the conditional character of negation and affirmation. If this is so, then all dies already being born and all is born already dying; all is possible already being impossible and all is impossible already being possible. Truth is only insomuch as, inasmuch as lie exists, and lie is only insomuch as, inasmuch as truth exists. The above stated is not an invention of a sage, but it is the fact that is observed in nature…"

Mathematically, the symmetry is expressed in an existence of the *two algebras*: *Yes*-algebra, presented by the equalities (2.5) (L. 5), and *No*-algebra, expressed by the equalities (2.6) (L. 5). Thus, the complete description of the potential-kinetic field is built on the basis of the two real (in the equal degree) units.

The power $1\omega t$ of the number $ae^{1\omega t}$, based on the real unit 1, defines the *quantitative* ("radial" or "longitudinal") change of the magnitude *a*. On the contrary, the power $\dot{1}\omega t$ of the same number $ae^{\dot{1}\omega t}$, based on the real unit $\dot{1}$, defines the *qualitative* ("transversal") change of the magnitude, which is represented, in the simplest case, by the rotation of the quantity *a* in space.

The transversal changes of this number are represented, using Euler's formula, as

$$ae^{\dot{1}\omega t} = a(\cos\omega t + \dot{1}\sin\omega t). \qquad (4)$$

Owing to the same mathematical operation that they represent, *i.e.*, $\sqrt{-1}$, the real unit of negation $\dot{1}$ and imaginary unit *i* are identical, $\dot{1} \equiv i$, hence, substituting $\dot{1}$ with *i*, the equation (4) takes the conventional form of complex functions,

$$ae^{i\omega t} = a(\cos\omega t + i\sin\omega t). \qquad (5)$$

We stress here again that in this equation both its opposite terms are *real* because *sine* (say *No*) *is the negation of cosine* (say *Yes*) (just as *cosine is the negation of sine*) and the unit *i* indicates only on this circumstance, and nothing more,

$$Yes = a\cos\omega t. \qquad No = ia\sin\omega t \qquad (6)$$

3. A second example: an equation $x^2 + y^2 = r^2$

Let us consider an equation of the kind

$$x^2 + y^2 = r^2. \qquad (7)$$

According to classical notions, it is an elementary equation of a circumference. However, in dialectical physics, it is not completely so. A graph of the equation is not uniquely and unambiguously such as it is accepted in modern mathematics, namely, it depends on the structure of the equation,

$$(\,)^2 + (\,)^2 = r^2, \qquad (8)$$

and on algebras of signs to which the variables *x* and *y* are obeying (see Fig. 2). What do we mean?

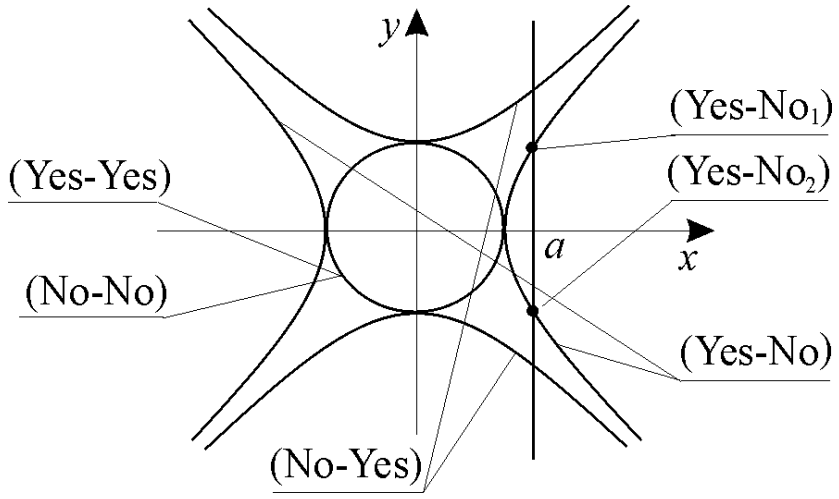

Fig. 2. The chart shows all possible solutions of the equation $x^2 + y^2 = r^2$. The straight line $x = a > r$ intersects the graph at two points, *Yes-No*$_1$ and *Yes-No*$_2$, for the case when $x = a$ is the number of affirmation, *Yes*. The *x* and *y* are coordinate axes neutral with respect to two algebras of signs.

If *x* and *y* are numbers of affirmation, then this equation describes a part *Yes-Yes* of the graph (circumference). When *x* are numbers of affirmation and *y* are numbers of negation, we obtain two branches *Yes-No* (left and right). If *x* are numbers of negation and *y* are numbers of affirmation, two branches *No-Yes* are formed (up and down). In a case when the structure of the equation has the more general form $(\,)^2 + (\,)^2 = (\,)^2$, the branch *No-No* takes place.

Evidently, in the binumerical field, the straight line $x = a > r$ intersects the second order curve $x^2 + y^2 = r^2$ (if *x* are *Yes* numbers, and *y* are *No* numbers) at two points, whereas according to classical concepts, there are no intersections.

When analyzing the relations between the numbers *Yes* (*a*) and *No* (*ib*), the notion of a phase plane of affirmation-negation numbers, where *x*-axis is the axis of affirmation and *y*-axis is the axis of negation, is useful to introduce. On this plane, a binumber is presented by *a* and *ib* components and also by the quantitative module *r* and polar phase angle α (Fig. 3), although in reality, *a* and *ib* can have arbitrary directions or be undirected magnitudes.

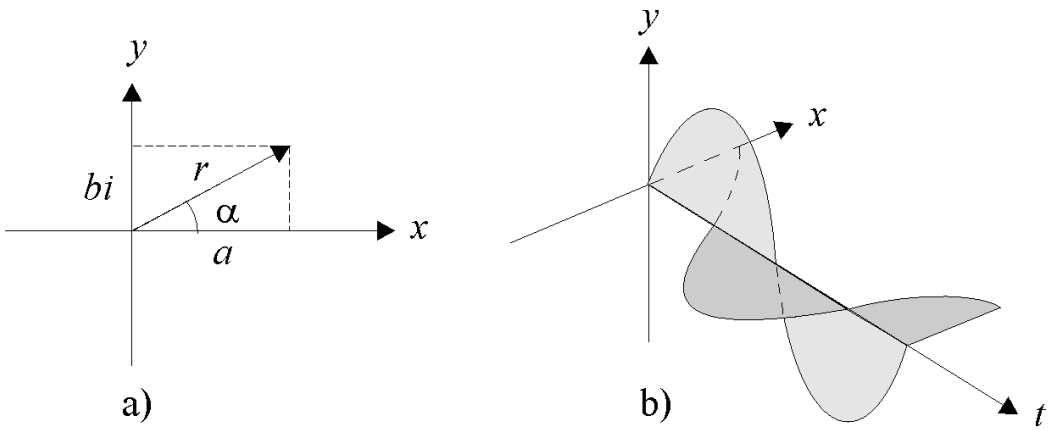

Fig. 3. A phase plane of a binumber, and the wave of affirmation-negation of bifield.

The quantitative-qualitative presentation should be used in the description of all studying physical phenomena and objects. Let us consider further, also in detail, another simple example taken from a school book of problems.

4. A third example: an equation of motion

Suppose we need to determine the time of motion of a body thrown vertically up from the point 0 with the initial speed $\upsilon_0 = 30\ \ m \times s^{-1}$ if the passed distance is $l = 125\, m$ (Fig. 2a). An air resistance is not taken into account and it is assumed that the acceleration of objects in free fall near earth is $g = 10\ \ m \times s^{-2}$.

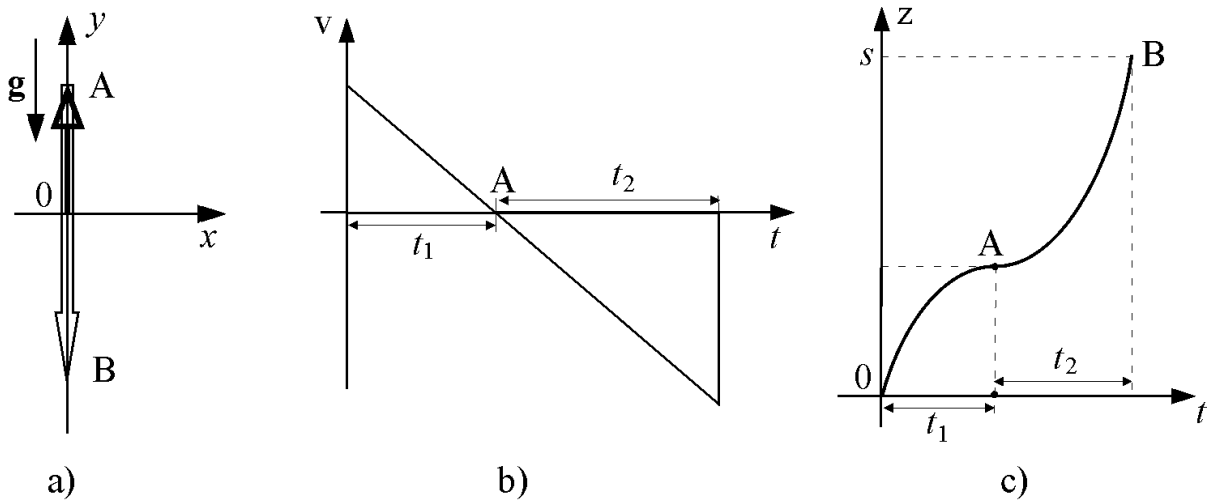

Fig. 2. The motion of a body thrown vertically up (a); plots of the velocity υ (b) and the displacement l (distance) (c); z is the axis of displacement (distance).

The parts of trajectory of motion OA and AB with *opposite* characters of motion and the time intervals t_1 and t_2 relate as the past and the future; therefore, they belong to the different algebras of signs (Fig. 2b). The binumerical field takes this singularity of motion into account.

The corresponding equation of uniformly variable motion of a body takes the form

$$l = \upsilon_0 t - \frac{gt^2}{2} \qquad \text{or} \qquad gt^2 - 2\upsilon_0 t + 2l = 0\,. \qquad (9)$$

The negative discriminant of this equation,

$$D = 4\upsilon_0^2 - 8gl < 0\,,$$

must not embarrass us because we do not operate with complex numbers. We can extract the square roots from negative numbers. Solutions of Eq.(6) in the field of binary numbers are real and have the form

$$\hat{t} = t_1 \pm it_2 = \frac{\upsilon_0}{g} \pm i\frac{\sqrt{2gl - \upsilon_0^2}}{g} = 3 \pm 4i\ (s)\,.$$

The final speed is

$$\upsilon = -\sqrt{2gl - \upsilon_0^2}\,,$$

hence, the time of motion is represented by the binary number

$$\hat{t}_+ = t_1 + it_2 = \frac{\upsilon_0}{g} + \frac{\sqrt{\upsilon_0^2 - 2gl}}{g} = \frac{\upsilon_0}{g} - i\frac{\upsilon}{g} = 3 + 4i \ \ (s).$$

The solution with the *positive sign* expresses the fact that the *direction of motion* is strictly along the trajectory and does not change. This is the absolute (proper) direction of trajectory.

On the other hand, the conjugated value of time $\hat{t}_+^* = t_1 - it_2$ indicates that the *past displacement* OA and the *future displacement* AB are opposite in sign with respect to the *y*-axis.

With respect to the future of two sections of motion, the times t_1 and t_2 are the past times. So that the norm [3] of the compound time determines the total time of motion $t_+ = t_1 + t_2 = 7 \ \ (s)$, and the modulus squared of the past-future time $\left|\hat{t}\right|^2 = t_1^2 + t_2^2$ determines the covered distance

$$l = \frac{g(t_1^2 + t_2^2)}{2}.$$

Any trajectory is characterized by two closely related parameters: the distance *l* and the coordinate *y* of a body. It means that any point of space is not only a coordinate, but also the final point of a traversed path of motion, which it represents. These parameters are expressed in Eq.(6) by one symbol *l* in accordance with the initial conditions (the passed distance *l*) of the problem.

Let us to introduce $\hat{t}_+ = t_1 + it_2 = 3 + 4i$ in Eq.(6), we obtain

$$l = \upsilon_0\hat{t}_+ - \frac{g\hat{t}_+^2}{2} = \upsilon_0 t_1 - \frac{gt_1^2}{2} + \frac{gt_2^2}{2} + (\upsilon_0 - gt_1)it_2,$$

but $(\upsilon_0 - gt_1) = 0$ and $\upsilon_0 t_1 - \frac{gt_1^2}{2} = \frac{gt_1^2}{2}$, hence,

$$l = \frac{gt_1^2}{2} + \frac{gt_2^2}{2} = \frac{g\hat{t}\hat{t}^*}{2} = gt_m^2 = 125 \ m,$$

where $t_m^2 = \hat{t}_+\hat{t}_+^*$ is the square modulus of time. If we will take the time $\hat{t}_+^* = t_1 - it_2$, we will arrive at the same result.

In the binumerical field, *there are no imaginary solutions*. All solutions are right because in reality displacement and distance represent different facets of the same process that explicitly expresses the binumerical field. At the section OA (Fig. 2c), the distance and the displacement are equal; this section is related to the lower branch of the parabola, described by the *algebra of*

affirmation, whereas the upper branch of the parabola is described by the *algebra of negation* – it determines the covered distance AB.

With respect to the final point B, the past and future, OA and AB, are the past OB. Therefore, they will be characterized by the same positive algebra of signs. In this case, the general time $t_+ = t_1 + t_2$ defines the final *coordinate* of a body:

$$l = \upsilon_0 t_+ - \frac{gt_+^2}{2} = \upsilon_0(t_1 + t_2) - \frac{gt_1^2}{2} - \frac{gt_2^2}{2} - gt_1t_2 =$$

$$= \upsilon_0 t_1 - \frac{gt_1^2}{2} - \frac{gt_2^2}{2} - (\upsilon_0 - gt_1)t_2 = \frac{gt_1^2}{2} - \frac{gt_2^2}{2}$$

or

$$l = y = \frac{gt_1^2}{2} + \frac{g(it_2)^2}{2} = -35\ m\ .$$

5. Conclusion

We assume you already came to understanding of the fact that the above considered means that we have revealed the essence of complex numbers (functions), the physical meaning of both their constituents, "*real*" and "*imaginary*", with the *imaginary unit i*, or not yet?

The notions of *real* and *ideal* ("*imaginary*") are relative. For example, the *longitudinal* (radial) *quantitative* ('*real*') motion of the Sun is accompanied by the *transversal qualitative* ('*ideal*') motion of its planets. Simultaneously, with respect to the center of our Galaxy, the motion of the Sun is '*ideal*'. Such is the Universe. The same relation occurs in the microworld, where an "*electric*" field-space, as the longitudinal one, is quantitative ('*real*'); whereas the '*magnetic*' field-space, as the transversal one, is qualitative ('*ideal*').

All above described allows us to state that we have revealed the deep meaning of *imaginary numbers* and the role that the "*imaginary*" unit, *i*, plays in it. Namely, as it turned out

> the "*imaginary*" unit *i* is merely an indicator of negative algebra of signs, to which "*imaginary*" numbers (parameters), conjugate to "*real*" ones, obey.

Thus, dialectics removes the last "*imaginary*" (unreal) number from mathematics, expanding the scope of science and harmonizing mathematical structures with the laws of the Universe.

Below is a comparative table clearly showing the difference between formal and dialectical logics on the example of the structure of two sets of numbers, complex and dialectical, revealing the meaning of all their constituents.

Table 1. The difference between complex numbers of the formal logic (accepted in physics and mathematics) and material-ideal binumbers of the dialectical logic

Complex number $\hat{Z} = a + ib$		*Dialectical material-ideal binumber* $\hat{Z} = a + ib$
a is (and called) a ***real number***.		a is a *real number* called a ***material number.***
i is considered in modern mathematics as *unreal* (*mystic*) *unit* due to ignorance of its true meaning; it is called, therefore, the ***imaginary unit***. Accordingly, the product		i is an indicator, points out that the term (parameter) b is qualitatively different polar-opposite to the term a, negating it. It is called, symbolically and for harmonize, the ***ideal unit***.
ib is an *unreal number* called, naturally, similarly as i, an ***imaginary number***.		ib is a *real number* called, in opposite to the number a, an ***ideal number***.

An appearance of complex numbers in the contradictory material-ideal nature of the World is not casual. The Material-Ideal World *imposed these numbers to mathematics in the hope that sooner or later the mystery of the imaginary unit i will be revealed by humankind*. And, as follows from this and previous Lectures, this prediction has finally comes true and becoming reality.

References

[1] G. P. Shpenkov, *Conjugate Fields and Symmetries*, APEIRON, Vol. 11, No. 2, 349-371, (2004); http://redshift.vif.com/JournalFiles/V11NO2PDF/V11N2SHP.pdf

[2] *Antology of the World Philosophy*, Vol. 1 (Mysl, Moscow, 1969), Part 1.

[3] L. Kreidik and G. Shpenkov, *Foundations of Physics: 13.644…Collected Papers*, Geo. S., Bydgoszcz, 1998, 272 p.

Lecture 8

Bipolar Character of Physical Processes

1. Introduction

We are continuing consideration of the bipolar (kinetic-potential) distinguishing feature of physical processes, begun in Lecture 4, and turn again to describing harmonic oscillations [1-3]. Symmetrical parameters of the field of motion-rest give a complete picture of real periodic (oscillatory and wave) processes, where mutual transformation of motion into rest and of rest into motion occurs.

Possibilities of the dialectical binumerical field of real numbers are demonstrated here on an example of the enhanced description of harmonic oscillations. These allow for a more exact and complete clarification of the given process, its potential-kinetic character. Symmetrical notions provide a complete picture of the phenomena of the periodic nature.

Making use of material-ideal measures, physics based on dialectical logic allows an adequate description of logically real contradictions in nature. Formal logic in the course of more than 2000 years could not solve this problem in principle, because it rests upon erroneous abstract-mathematical postulates. Treating its own postulates as uniquely correct, formal logic, with all its methods, had banished real contradictions of the World away from

science. As a result, modern physics experienced failure in understanding such fundamental things as the origin of mass and the nature of electric charges that, in turn, as an effect, led to a misunderstanding of the atomic and elementary particles structure, and other faults. Concepts on the atomic structure and interpretation of the wave function take a unique place in this variety.

In view of an exceptional significance of this subject, dialectical physics solutions of the wave equation (its spatial constituent) in the form of the *bipolar wave function*, resulted in the discovery of shell-nodal structure of the atoms, are shown at the end of the Lecture. This material is presented here very briefly to turn attention mainly on to the *bipolar character* of the wave function and elucidating the physical meaning of both its constituents (unfortunately, not understood by creators of quantum mechanics). So we should regard it as introductory information about the aforementioned solutions. The subsequent Lectures collected in Vol. 3 will be especially devoted to the complete and detailed description of this crucial issue.

2. Biparameters of oscillations

Harmonic oscillations of motion-rest in terms of the dialectical binumbers are presented by the kinetic-potential displacements:

$$\hat{x} = x_k + ix_p = x_m e^{i(\omega t+\alpha)} = x_m(\cos(\omega t+\alpha) + i\sin(\omega t+\alpha)) \qquad (2.1)$$

or

$$\hat{x} = x_k - ix_p = x_m e^{-i(\omega t+\alpha)} = x_m(\cos(\omega t+\alpha) - i\sin(\omega t+\alpha)). \qquad (2.1a)$$

The kinetic displacement is the displacement of motion from an equilibrium state, whereas the potential displacement is the displacement of rest from a nonequilibrium state.

If we introduce the biamplitude of oscillations,

$$\hat{x}_m = x_m e^{i\alpha}, \qquad (2.2)$$

then harmonic oscillations (2.1) can be written in the form,

$$\hat{x} = x_k + ix_p = \hat{x}_m e^{i\omega t}. \qquad (2.3)$$

Using for description of oscillations an equation (2.1) with the zero initial phase ($\alpha = 0$), we arrive at the following series of kinetic and potential parameters of the bifield of motion-rest presented in Table 1.

Table 1. The kinetic-potential parameters of motion-rest

	Kinetic (***Yes***)	***Potential*** (***No***)
1) *Displacement*	$x_k = x_m \cos\omega t$,	$x_p = -ix_m \sin\omega t$
2) *Speed of displacement*,	$\upsilon_k = \dot{x}_k = -\omega x_m \sin\omega t = -i\omega x_p$,	$\upsilon_p = \dot{x}_p = -i\omega x_m \cos\omega t = -i\omega x_k$
3) *Acceleration of displacement*,	$w_k = \ddot{x}_k = -\omega^2 x_k$,	$w_p = \ddot{x}_p = -\omega^2 x_p$
4) *Momentum*	$p_k = m\upsilon_k = m\dot{x}_k$,	$p_p = m\upsilon_p = m\dot{x}_p$
5) *The rate of change of momentum (power of exchange by motion-rest, when its measure is momentum)*	$F_k = m\frac{d\upsilon_k}{dt} = m\ddot{x}_k = -kx_k$,	$F_p = m\frac{d\upsilon_p}{dt} = m\ddot{x}_p = -kx_p$
6) *Energy*	$E_k = \frac{m\upsilon_k^2}{2} = -\frac{kx_p^2}{2}$,	$E_p = \frac{kx_k^2}{2} = -\frac{m\upsilon_p^2}{2}$
7) *The rate of change of energy (power of exchange of motion-rest, if energy is its measure)*	$N_k = \frac{dE_k}{dt} = F_k\upsilon_k$,	$N_p = \frac{dE_p}{dt} = -F_p\upsilon_p$

3. Free oscillations

An equation of free kinetic-potential oscillations of the simplest system (Fig. 5a) in the binumerical field has the following form

$$\frac{d^2\hat{x}}{dt^2} + 2\beta\frac{d\hat{x}}{dt} + \omega_0^2\hat{x} = 0, \qquad (3.1)$$

where $\beta = \frac{r}{2m}$ is the damping factor, $\omega_0^2 = \frac{k}{m}$ is the natural frequency of the oscillation.

The search for a solution to the equation (3.1) in the form $\hat{x} = \hat{x}_m e^{\eta t}$, where $\hat{x}_m = x_m e^{i\alpha}$ is the biamplitude, leads to the quadratic equation $\eta^2 + 2\beta\eta + \omega_0^2 = 0$, the positive root of which $\eta = -\beta + i\sqrt{\omega_0^2 - \beta^2} = -\beta + i\omega$. The frequency

$$\omega = \sqrt{\omega_0^2 - \beta^2} \tag{3.2}$$

determines the damped kinetic-potential displacement

$$\hat{x} = \hat{x}_m e^{i\omega t} = \hat{x}_m(\cos\omega t + i\sin\omega t). \tag{3.3}$$

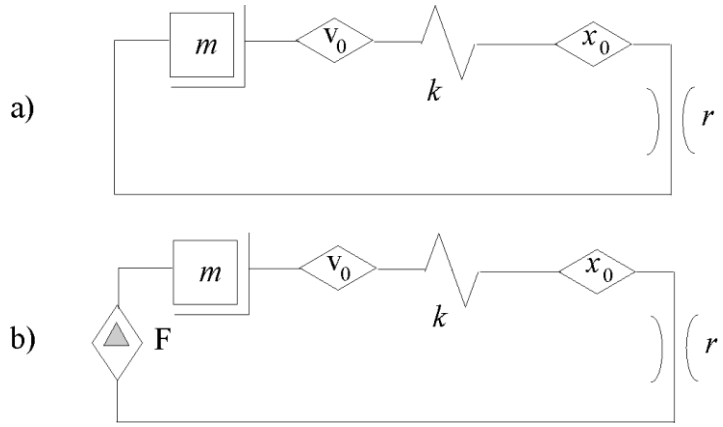

Fig. 5. Elementary kinematic systems with mass *m*, elasticity *k*, and resistance *r* without (a) and with (b) an external source *F* of motion-rest; υ_0 is the initial speed, x_0 is the initial displacement.

The kinetic-potential biamplitude is

$$\hat{x}_m = x_m e^{i\alpha} e^{-\beta t} \tag{3.4}$$

At $t = 0$, the biamplitude (3.4) determines the initial state of the system:

$$\hat{x}(0) = \hat{x}_m = x_m e^{i\alpha} = x_m \cos\alpha + i x_m \sin\alpha, \tag{3.5}$$

where $x_k(0) = x_m \cos\alpha$ is the initial kinetic displacement and $\tilde{x}_p(0) = i x_m \sin\alpha$ is the initial potential displacement.

4. Forced oscillations

When analyzing the influence of an external periodic kinetic-potential action $\hat{F} = F_m e^{i\omega t}$ on the elementary system (Fig. 5b), forced oscillations of the kind $\hat{Z} = \hat{Z}_m e^{i\omega t}$ arise.

Motion-rest in such a case will be described by the following differential equations of the kinetic-potential displacement $\hat{x} = \hat{x}_m e^{i\omega t}$, speed $\hat{\upsilon} = \hat{\upsilon}_m e^{i\omega t}$, and acceleration $\hat{w} = \hat{w}_m e^{i\omega t}$, correspondingly:

$$m\frac{d^2\hat{x}}{dt^2} + r\frac{d\hat{x}}{dt} + k\hat{x} = \hat{F}; \qquad (4.1)$$

$$m\frac{d\hat{\upsilon}}{dt} + r\hat{\upsilon} + k\int \hat{\upsilon}dt = \hat{F}; \qquad (4.1a)$$

$$m\hat{w} + r\int \hat{w}dt + k\int dt\int \hat{w}dt = \hat{F} \qquad (4.1b)$$

These equations lead to the following three equations of motion-rest in the binumerical field

$$\hat{F} = \hat{k}\,\hat{x}, \qquad (4.2)$$

$$\hat{F} = \hat{r}\hat{\upsilon}, \qquad (4.2a)$$

$$\hat{F} = \hat{m}\hat{w}, \qquad (4.2b)$$

where

$$\hat{k} = (k - m\omega^2) + ir\omega, \qquad (4.3)$$

$$\hat{r} = r + i(m\omega - \frac{k}{\omega}), \qquad (4.4)$$

and

$$\hat{m} = (m - \frac{k}{\omega^2}) - i\frac{r}{\omega} \qquad (4.5)$$

are *bielasticity*, *biresistance*, and *bimass*, correspondingly.

The component $(k - m\omega^2)$ of bielasticity (4.3) defines the conservatism of the system, *i.e*., its ability to save rest and motion. In this equation, *k* is the coefficient of conservation of rest and $-m\omega^2$ is the coefficient of conservation of motion; whereas the component $ir\omega$ defines the no conservatism (dissipation) of the system, *i.e*. its ability to disperse rest-motion.

Hence, if the component $(k - m\omega^2)$ states the conservatism of the system, expressing its *Yes* quality, then the component $ir\omega$ is the negation of conservatism, expressing the *No* quality of the system.

Thus, the bicoefficient $\hat{k}$ (4.3) characterizes the contradictory conservative-dissipative system; therefore, in this sense, it can be called the conservative-dissipative coefficient of the system. The conservative coefficient $(k - m\omega^2)$ expresses the qualitative side of exchange of motion-rest, the dissipative coefficient $ir\omega$ – its quantitative facet.

In the phase plane of binumbers (Fig. 6a), $\hat{k}$ is represented in the trigonometric form $\hat{k}= k_m e^{i\varphi}$ with parameters

$$k_m = \sqrt{(k - m\omega^2)^2 + r^2\omega^2}\,, \tag{4.6}$$

$$tg\varphi = \frac{r\omega}{k - m\omega^2} = \frac{2\beta\omega}{\omega_0^2 - \omega^2}\,, \tag{4.7}$$

where k_m is the quantitative module and φ is the superstructure of the bielasticity $\hat{k}$. Since $\hat{F} = F_m e^{i\omega t}$ and $\hat{x}_m = x_m e^{i\alpha}$, then in accordance with (4.2) $\alpha = -\varphi$; therefore,

$$\hat{x}_m = \frac{F_m}{(k - m\omega^2) + ir\omega} \quad \text{and} \quad x_m = \frac{F_m}{\sqrt{(k - m\omega^2)^2 + r^2\omega^2}} \tag{4.8}$$

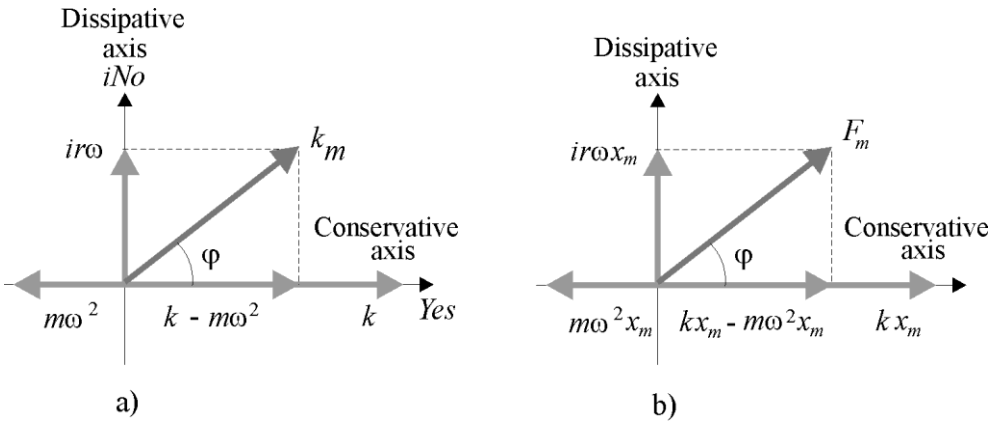

Fig. 6. Graphs of bielasticity $\hat{k}$ (a) and amplitudes (b).

The relation between the amplitudes (4.8) can be depicted by the graph of amplitudes (Fig. 6b).

Let us pass now to the second equation $\hat{F} = \hat{r}\hat{\upsilon}$ of (4.2) and consider the structure of biresistance $\hat{r}$ (4.4). The first component of biresistance, r is the active coefficient of dispersion – the coefficient of quantitative dispersion. The second component of (4.4),

$$i(m\omega - \frac{k}{\omega})\,, \tag{4.9}$$

is the *reactive coefficient of dispersion* – the coefficient of qualitative exchange by motion-rest, the first constituent of which $im\omega$ is the coefficient of exchange by motion and the second of their

$$-i\frac{k}{\omega}, \tag{4.10}$$

is the coefficient of exchange by rest.

In the trigonometric form, the coefficient of biresistance $\hat{r}$ can present as

$$\hat{r} = r_m e^{i\psi}, \tag{4.11}$$

where

$$r_m = \sqrt{r^2 + \left(m\omega - \frac{k}{\omega}\right)^2}, \tag{4.11a}$$

and

$$tg\psi = \frac{m\omega^2 - k}{r\omega} = \frac{\omega^2 - \omega_0^2}{2\beta\omega}. \tag{4.11b}$$

If $\hat{\upsilon}_m = \upsilon_m e^{i\alpha}$, then $\alpha = -\psi$ and

$$\hat{\upsilon}_m = \frac{F_m}{r + i\left(m\omega - \frac{k}{\omega}\right)}, \tag{4.12}$$

$$\upsilon_m = \frac{F_m}{\sqrt{r^2 + \left(m\omega - \frac{k}{\omega}\right)^2}}. \tag{4.12a}$$

Finally, the last equation $\hat{F} = \hat{m}\hat{w}$ of (4.2) includes bimass (4.5). Here are: m is the positive kinetic mass, absorbing motion; $-\frac{k}{\omega^2}$ is the negative potential mass of the system, absorbing rest; $-i\frac{k}{\omega}$ is the mass of dispersion of motion-rest.

In the trigonometric form, the bimass (4.5) is presented as

$$\hat{m} = m_m e^{i\vartheta}, \tag{4.13}$$

where

$$m_m = \sqrt{\left(m - \frac{k}{\omega^2}\right)^2 + \frac{r^2}{\omega^2}}, \tag{4.13a}$$

$$tg\vartheta = -\frac{\frac{r}{\omega}}{m - \frac{k}{\omega^2}} = -\frac{2\beta\omega}{\omega^2 - \omega_0^2}. \tag{4.14}$$

Hence,

$$\hat{w}_m = \frac{F_m}{\left(m - \frac{k}{\omega^2}\right) - \frac{ir}{\omega}} \tag{4.15}$$

and

$$w_m = \frac{F_m}{\sqrt{\left(m - \frac{k}{\omega^2}\right)^2 + \frac{r^2}{\omega^2}}} \tag{4.15a}$$

5. Bipolarity of the wave function

After introduction in science, the imaginary unit and, hence, imaginary numbers were and yet are regarded in modern physics as the great mystery. Basing on dialectics, we reveal this riddle in out Lectures. Now we will show how with regard to the aforementioned *binary feature of properties* we have arrived at the shell-nodal structure and symmetry of atomic structures.

The *wave exchange* of matter-space and motion-rest (*matter-space-time* for brevity) is in the nature of all physical phenomena; therefore, the *probability* of possible states at the wave exchange must also have the *wave bipolar character* and reflect the states of *rest* and *motion*. We use the notion of *exchange* instead of *interaction*. Why? The notion *exchange*, as more comprehensive and accurate, is more appropriate to the wave model. It embraces the *wave behaviour* of microobjects in their dynamic equilibrium with an ambient field both at *rest* and *motion*, and also their *interactions* with other objects [4].

The *possibility* of rest and motion gives birth to the potential-kinetic field of *reality*, where rest (*potential* field) and motion (*kinetic* field) are inseparably linked between themselves in the unit *potential-kinetic field* [3].

The *probability potential* as the *measure of possibility* and *reality*, introduced first in [2], describes any wave events, including probability of concentration of substance in specific points of space, in particular, in nodes where amplitude of oscillation in standing waves possesses the zero values.

Following the requirement of the symmetry, conditioned by the dialectical logic, the probability potential has the *binary potential-kinetic* structure

$$\hat{\Psi} = \Psi_p + i\Psi_k \tag{5.1}$$

and is determined by the product of *spatial* $\hat{\psi}(\rho, \theta, \varphi)$ and *time* $\hat{\Xi}(t)$ probabilistic functions:

$$\hat{\Psi} = \hat{R}(\rho)\Theta(\theta)\hat{\Phi}(\varphi)\hat{\Xi}(t) = \hat{\psi}(\rho, \theta, \varphi)\hat{\Xi}(t). \tag{5.2}$$

Amplitudes of the functions are described, respectively: by the spatial equation,

$$\Delta\hat{\psi} + k^2\hat{\psi} = 0\,, \tag{5.3}$$

and the *time* equation,

$$\frac{d^2\hat{\Xi}}{dt^2} = -\omega^2\hat{\Xi}, \tag{5.4}$$

where

$$k = \frac{2\pi}{\lambda} = \frac{\omega}{c} \tag{5.5}$$

is the *wave number*, the constant quantity.

> *Solutions of* (5.3) *give us the structure of* ***standing waves*** *in three dimensional space, the positions of nodes and antinodes in them.*

After the conventional separation of variables related to three space dimensions, Eq. (5.3) falls into the equations of radial $\hat{R}_l(\rho)$, polar $\Theta_{l,m}(\theta)$, and azimuth $\hat{\Phi}(\varphi)$ functions.

Solutions of the radial function $\hat{R}_l(\rho)$, for any model of an object of study, define a spectrum of characteristic spheres ($l = 0, 1, 2, 3, ...$) with:

(1) extremes – *antinode*s – the positions of maximum radial displacements in a standing wave system, and
(2) zeroes – *nodes* – the positions where radial displacements are equal to zero [4].

Polar components $\Theta_{l,m}(\theta)$ of $\hat{\psi}$ define a series of characteristic parallels of extremes and zeroes (primary and collateral) on respective radial spheres (shells).

Azimuth components $\Phi_m(\varphi)$ define characteristic meridians of extremes and zeroes.

Potential and *kinetic* polar-azimuth probabilities select together the *distinctive positions* (*coordinates*) of nodes (respective to *zeroes*) and antinodes (respective to *extremes*) on the radial shells.

Solutions of the above functions show that there are *primary* and *collateral extremes* (*antinodes*) and *zeroes* (*nodes*). The zeroes determine *stable* and *metastable* states of probabilistic events. We regard (and also call so) ***nodes*** and ***antinodes***, respectively, as ***potential nodes*** and ***kinetic nodes***.

As an example, a particular case, related to a *potential* component of the solution for the $\hat{\psi}$ function at $l = 5$ and $m = 2$, is shown graphically in Fig. 7.

A graphical image of the kinetic constituent $\psi_{5,2}(\rho, \theta, \varphi)_k$ is similar in form (not shown here) to the potential one $\psi_{5,2}(\rho, \theta, \varphi)_p$ depicted in Fig. 7. The difference between potential and

kinetic solutions is in the *different angular coordinates* of nodes and antinodes and the *different radii* of spherical radial shells - potential and kinetic. Namely, angular positions of antinodes of the kinetic component are shifted in azimuthal direction in respect to the position of nodes of the potential component as it follows from the functions $\hat{Y}_{l,m}(\theta,\varphi)$:

$$Y_{l,m}(\theta,\varphi)_p = C_{l,m}\Phi_m\Theta_{l,m}\cos m\varphi \qquad (5.6)$$

$$Y_{l,m}(\theta,\varphi)_k = C_{l,m}\Phi_m\Theta_{l,m}\sin m\varphi \qquad (5.6a)$$

where $C_{l,m}$ is the normalizing factor.

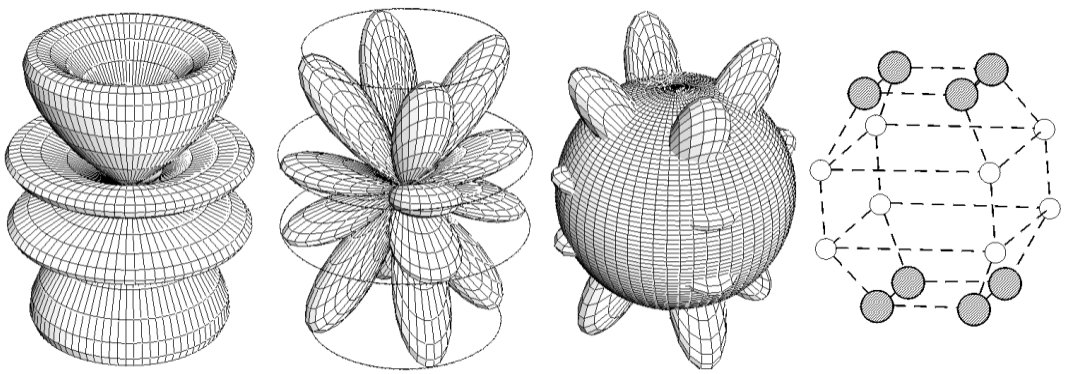

Fig. 7. The graphs of the functions, $\Theta_{5,2}$ (θ) (a) and $Y_{5,2}$ (θ, φ) (b). The function $Y_{5,2}$ (θ, φ) is imaged as combined (shown here just conditionally) with an arbitrary spherical surface (c), to clearly discern an angular spatial disposition (d) of *primary* and *collateral potential* nodes (designated, respectively, by shaded and blank spheres). These nodes relate to *zeroes* of radial potential function $\hat{R}_5(\rho)_p$ in the spherical field of the probability $\psi_{5,2}(\rho,\theta,\varphi)_p$ (*potential* constituent) [4, 5].

The radial component of the solutions, $\hat{R}_l(\rho)$, has the binary structure as well (the sign above "∧" indicates on this). Antinodes of the kinetic component of the solutions are, correspondingly, on the kinetic radial shells situated between (shifted with respect to) potential shells.

Nothing surprising, such is an interference picture of standing waves with alternating nodes and antinodes. Nodes and antinodes are *shifted* in both *azimuthal* and *radial directions* relative to each other.

Bipolar character of the wave function reveals the structure of atoms and crystals.

The *quasi-periodicity*, or *quasi-similarity*, of shells responding to different quantum numbers *l* at the same $m = l - 1$ is clearly seen when all corresponding graphs being collected are presented

together [6, 7] (we intend to consider this subject in detail in the subsequent Lectures, in Volume 3).

The completely realized polar-azimuth *n*-th shell of the *potential nodes* is defined, in accordance with the wave probabilistic equation (5.3), by the function

$$\Psi_{l,m}(\rho_{l,n}, \theta, \varphi)_p = C_\Psi R_l(\rho_{l,n})\Theta_{l,m}(\theta)\cos(m\varphi + \alpha), \qquad (5.7)$$

where $\rho_{l,n}$ is the radius of *n*-th extremal radial shell of the function $R_l(\rho)$. We will call such shells the *whole shells*. The geometry of shells is determined by the polar-azimuth functions.

The "*fractional*" (uncompleted) *shells* are defined by the half-integer solutions of the form

$$\Psi_{l,l}(\rho_{l,n}, \theta, \varphi)_p = C_\Psi R_l(\rho_{l,n})\sin^l\theta\cos(l\varphi + \alpha), \qquad (5.8)$$

where *l* is a real number, with extremes lying in the equatorial plane.

In a general case, the complete structure of *any probabilistic object* (called an *abstract atom* [4]) with the ordinal number *Z* is defined by the two sums:

$$\begin{aligned}\Psi_Z = &\sum C_\psi R_l(\rho_{l,n})\Theta_{l,m}(\theta)\cos(m\varphi + \alpha_m) + \\ &+ \sum C_s R_s(\rho_{s,j})\sin^{s/2}\theta\cos\left(s/2\,\varphi + \beta_s\right),\end{aligned} \qquad (5.9)$$

where the subscript *Z* indicates the number of primary nodes and, simultaneously, the ordinal number of the last primary node of a *probabilistic object*; $s = 0, 1, 2, 3, \ldots$; α_m and β_s are the initial phases. The first sum in (5.9) consists of embedded whole shells (recalling a set of nesting dols); the second sum consists of embedded half-integer subshells. The ordinal numbers *Z* correspond to the atomic numbers of Mendeleev's Table [6, 7].

The extremes and zeros of the phase probability are significant in an equal degree. Zero values of the wave spherical field of probability define the radial shells of zero probability of radial displacements (oscillations). Naturally, they are the shells of stationary states. On the contrary, shells of extremal values of the wave field of probability define domains of more intensive radial displacements and, accordingly, these shells describe nonstationary (unstable) states.

Thus, the extremes of the wave field of probability do not quite mean that they are domains of the most probable localization of microparticles. To the point note that the *quantum-mechanical* formalism, accentuating the attention to *extremes* of the wave function squared, is unable to describe the qualitative peculiarities of probabilistic processes.

6. Conclusion

A wave *bipolar character of physical processes* is presented by the corresponding wave binumerical field of *real numbers* suitable for describing real wave processes in a *three dimensional space*, which is impossible to describe correctly by the conventional field of complex, *real* and "*imaginary*" (unreal), numbers localized in a *complex plane*.

Really, misunderstanding of the true nature of "*imaginary*" numbers has forced physicists to drop "*an imaginary part*" of the wave function, which "*does not have a physical meaning*", as they assumed at that time (and, unfortunately, believe till now), and operate only with a modulus squared of the wave function. This step led to the creation of an erroneous theory in physics – quantum mechanics [10].

Binary wave functions, reflecting the *symmetry-asymmetry* of polar opposite (*potential* and *kinetic*) properties of spaces [3], yield information about the atomic structure and morphology (*symmetry*) of crystals. Half-integer solutions (5.9), having in an equatorial plane the *any-fold symmetry*, reveal the true origin of the symmetries (five- [8], seven-, eight-fold, *etc*.) regarded in science as "*strictly forbidden by the mathematical laws of crystallography*" [9], which attracts last time the world-wide attention.

Looking ahead we would like also to note that numerous other data obtained indicates that the well-known *law of constancy of angles between edges* (and facets) for all crystals of the same substance has the wave nature. This conclusion is based on the fact that, as was found, the characteristic angles of crystals exactly coincide with the characteristic angles of wave functions [4, 10, 11]; they repeat at the macrolevel the angles of the disposition of corresponding atomic nodes and define the shape of crystals [12].

The comprehensive analysis, conducted in [4], revealed also the fact that the directions of chemical bonds in ordered structures (molecules) are determined by superposition of elementary solutions of Eq. (5.7) for the wave probabilistic field [13 - 15]. We hope that these solutions will be used in future for predicting the large variety of new molecular and crystalline structures. Dialectical physics solutions uncover the real nature of Mendeleev's Periodic Law [6, 7] and led to other important results not discussed here. We will consider all the questions, touched above briefly, in the next volumes of the Lectures in detail.

References

[1] G. P. Shpenkov, *Conjugate Fields and Symmetries*, APEIRON, Vol. 11, No. 2, 349-371, (2004); http://redshift.vif.com/JournalFiles/V11NO2PDF/V11N2SHP.pdf

[2] L. Kreidik and G. Shpenkov, *Foundations of Physics: 13.644…Collected Papers*, Geo. S., Bydgoszcz, 1998, 272 p.

[3] G. Shpenkov and L. Kreidik, *Conjugated Parameters of Physical Processes and Physical Time*, Physics Essays, Vol. 15, No. 3, (2002).

[4] L. Kreidik and G. Shpenkov, *Atomic Structure of Matter-Space*, Geo. S., Bydgoszcz, 2001, 584 p.

[5] G. Shpenkov and L. Kreidik, *Discrete Configuration of Probability of Occurrence of Events in Wave Spaces*, Apeiron, Vol. 9, No. 4, 91-102, (2002); http://redshift.vif.com/JournalFiles/V09NO4PDF/V09N4shp.pdf

[6] G. P. Shpenkov, *An Elucidation of the Nature of the Periodic Law*, Chapter 7 in "*The Mathematics of the Periodic Table*", edited by Rouvray D. H. and King R. B., NOVA SCIENCE PUBLISHERS, NY, 2005.

[7] G. Shpenkov, *Generalized Table of the Elements*; http://shpenkov.com/pdf/placard.pdf

[8] D. Shechtman, I. Blech, D. Gratias, and J.W. Chan, *Metallic Phase with Long-Range Orientation Order and no Translation Symmetry*, Phys. Rev. Lett., 53, No. 20, 1984, pp. 1951-1953.

[9] P.J. Steinhardt and H.C. Jeong, Nature, Vol. 382, pp. 433-435 (1996); *New Rules for Constructing Penrose Tilings May Shed Light on How Quasicrystals Form*; http://dept.physics.upenn.edu/~www/astro-cosmo/walker/walker.html

[10] G. Shpenkov and L. Kreidik, "*Schrodinger's Errors of Principle"*, Galilean Electrodynamics, 3, **16**, 51-56, (2005); http://shpenkov.com/pdf/blunders.pdf

[11] L. Kreidik and G. Shpenkov, *Alternative Picture of the World*, Bydgoszcz, 1996, Vol. 1-3 (148, 156, 178 p.)

[12] L. Kreidik and G. Shpenkov, *A Wave Field of Probability and the Form of Crystals*, Abstracts, p. 258, 18th IUCr Congress & General Assembly, 4th-13th August, 1999, Glasgow, Scotland.

[13] L. Kreidik and G. Shpenkov, *Nucleon Shells of the Atom and the Structure of Molecules* (*Chemistry of Nucleon Bonds*), Proceedings of The 5th Int. Conf. on Intermolecular Interactions in Matter, pp. 61-66, Politechnika Lubelska, 2-4 September, Lublin, Poland, 1999.

[14] L. Kreidik and G. Shpenkov, *The Wave Equation Reveals Atomic Structure, Periodicity and Symmetry*, Kemija u Industriji, **51**, 9, 375-384, (2002).

[15] G. P. Shpenkov, *The Role of Electrons in Chemical Bonds Formations* (*In the Light of Shell-Nodal Atomic Model*), Molecular Physics Reports **41**, 89-103, (2005).

Lecture 9

Dialectical Concept of Time

1. Introduction

What is time? That is a huge age-old question that has lots of different aspects to it. A lot of issues go back to the beginning of the past century conditioned by appearing of the space-time concept of relativity, and how we measure time using clocks. Heidegger in his lecture, "*The concepts of Time in the Science History*", at the University of Freiburg, July 27, 1915 [1], argues: "The goal of physics as a science is the unity of the physical theory of the world, the reduction of all phenomena to the mathematically established basic laws of general dynamics - laws of motion that apply to any mass that needs to be detected." "Concisely put, the object of physics is law-governed motion. *Motions run their course in time – but what does that mean*? The "*in*" of "*in time*" has a spatial meaning; but obviously time is not spatial; in fact, we constantly contrast space and time."

Within that framework, "*time is understood as a homogeneous series of quantitative points that functions as a flat scale for measuring motion*" [1]. Till now, for many people, time is a linear concept. Time is considered as a sequence of moments in a linear order.

So, yet despite 2,500 years of investigating time, many issues about time are unresolved. It is because the main question is still opened: *What actually is time*? Specifying this issue we would like to know the following important aspects of the concept: *What is the structure and dimensionality of time?* In this Lecture, we present the dialectical view to these questions.

2. An ideal (mathematical) time

The wave $\hat{\Psi}$ –function,

$$\hat{\Psi} = \hat{R}(r)\Theta(\theta)\hat{\Phi}(\varphi)T(t) = \hat{\psi}(r,\theta,\varphi)\hat{T}(t)\,, \tag{2.1}$$

satisfying the ordinary wave equation

$$\Delta\hat{\Psi} = \left(\frac{1}{\upsilon_0^2}\right)\frac{\partial^2\hat{\Psi}}{\partial t^2}, \tag{2.2}$$

describing arbitrary periodic processes running in space and time, is the mathematical expression of the indissoluble bond of the fields of material space and physical time. The time function

$$\hat{T}(\omega t) \tag{2.3}$$

expresses the *alternating physical time field* by means of the variable *t*, which represents the *ideal mathematical time* of the imaginary absolute uniform motion. Its simplest solution is

$$T = e^{\pm i\omega t}\,. \tag{2.4}$$

The real times of natural processes are compared with this mathematical time. We call mathematical time, *absolute* or *reference time*.

3. A real (physical) time

The *physical time*, as the measure of pure motion-rest, must also be *potential-kinetic*. Let us show this. By analogy with the absolute time

$$t = \frac{l}{\upsilon}, \tag{3.1}$$

the *physical time of harmonic oscillations* $\hat{t}$ is defined as the ratio of the potential-kinetic displacement $\hat{\Psi}$ to the module of potential-kinetic speed *υ*:

$$\hat{t} = \frac{\hat{\Psi}}{\upsilon} = \frac{ae^{i\omega t}}{\omega a} = t_m e^{i\omega t} = t_k + it_p\,. \tag{3.2}$$

In this expression,

$$t_m = \frac{1}{\omega} = \frac{T}{2\pi} \tag{3.3}$$

is the module of the potential-kinetic time. The *kinetic* and *potential times*,

$$t_k = t_m \cos \omega t \tag{3.4}$$

and

$$it_p = it_m \sin \omega t \tag{3.5}$$

are functions of the uniform mathematical time *t*. In the capacity of the basic unit of physical time, we accept the *second* of the absolute time.

The physical time allows the more complete description of the *dialectically contradictory potential-kinetic processes*. The physical time is the time of the logical structure *Yes-No*. As follows from the definition of physical time,

$$\hat{\Psi} = \upsilon \hat{t}\,, \qquad x_k = \upsilon t_k\,, \qquad ix_p = \upsilon i t_p\,. \tag{3.6}$$

The physical time repeats the form of the potential-kinetic displacement. The equations of displacements (3.6), defined by the physical time, are similar, in form, to the equation of displacement *l* in the uniform motion on the basis of reference time *t*:

$$l = \upsilon t\,. \tag{3.7}$$

By analogy with the relations between contents and form, the relations between the extension of space and the duration of time, we express through the speed as

$$\upsilon = \upsilon_0 \upsilon_r\,, \tag{3.8}$$

where

$$\upsilon_0 = 1\ cm \times s^{-1} \tag{3.9}$$

is the absolute unit speed and υ_r is the relative speed.

We also introduce the "inverse speed" ς according to the equality

$$\varsigma = \frac{1}{\upsilon} = \varsigma_0 \varsigma_r\,, \tag{3.10}$$

where

$$\varsigma_0 = 1\ s \times cm^{-1} \tag{3.11}$$

is the absolute unit of the inverse speed and ς_r is the relative inverse speed.

Resting upon Eqs. (3.8) and (3.10), we can rewrite the equation of displacement (3.7) in two ways:

$$l = \upsilon_0 \upsilon_r t\,, \qquad t = \varsigma_0 \varsigma_r l\,. \tag{3.12}$$

Analogously, we express the relation between the displacement $\hat{\Psi}$ and time $\hat{t}$:

$$\hat{\Psi} = \upsilon_0 \upsilon_r \hat{t}\,, \qquad \hat{t} = \varsigma_0 \varsigma_r \hat{\Psi}\,. \tag{3.13}$$

The physical potential-kinetic time of harmonic oscillations in wave processes is the *wave time field*. It also is the *ideal space of matter*. Just this ***wave potential-kinetic time field enters in the dialectical triad, matter-space-time***. The physical time of harmonic oscillations

$$\hat{t} = t_m e^{i\omega t} = t_k + it_p \tag{3.14}$$

runs nonuniformly with the *time potential-kinetic speed*

$$\hat{\xi} = \frac{d\hat{t}}{dt} = ie^{i\omega t} = \xi_k + i\xi_p\,, \tag{3.15}$$

where

$$\xi_k = \frac{dt_k}{dt} = -\omega t_m \sin\omega t = -\sin\omega t \tag{3.16}$$

and

$$i\xi_p = \frac{dit_p}{dt} = i\omega t_m \cos\omega t = i\cos\omega t \tag{3.16a}$$

are the *kinetic and potential time speeds*, correspondingly.

The derivative of any $\hat{\Psi}$-function (describing an arbitrary physical field) with respect to some argument ζ defines a new field

$$\hat{\Xi} = \frac{d\hat{\Psi}}{d\zeta}\,. \tag{3.17}$$

This field is the *field of negation of the initial field*. Correspondingly, the derivative $d\hat{\Xi}/d\zeta$ defines the field of negation of the field $\hat{\Xi}$, *etc*. Thus, the field of the second derivative

$$\hat{\Sigma} = \frac{d^2\hat{\Psi}}{d\zeta^2} \tag{3.18}$$

of $\hat{\Psi}$-function is the *field of negation of negation* of $\hat{\Psi}$-field, or the *field of double negation* $\hat{\Sigma}$.

In such a case, the field, defined by the derivative

$$\hat{\xi} = \frac{d\hat{t}}{dt}\,, \tag{3.19}$$

represents by itself the *field of negation of the field of physical time*. This new field is the *time field of potential-kinetic motion of time*. As such, it is the ***quantitative-qualitative field of the Universe, because quantity and quality exist objectively in it.*** Its subjective image is the dialectical numerical field of affirmation-negation *Yes-No* [2]. The quantitative-qualitative

field of change of the physical time is simultaneously the material-ideal field, because quantity and quality are in the same relation, as material and ideal.

The space and time speeds are related by the following equalities:

$$\hat{\upsilon} = \upsilon_m \hat{\xi}\,, \qquad \upsilon_k = \upsilon_m \xi_k\,, \qquad i\upsilon_p = i\upsilon_m \xi_p\,. \tag{3.20}$$

The kinetic and potential energies, expressed with use of time speeds, have the form

$$E_k = E_m \xi_k^2\,, \qquad E_p = E_m \xi_p^2\,, \tag{3.21}$$

where

$$E_m = \frac{m\upsilon_m^2}{2} \tag{3.22}$$

is the amplitude of kinematic energy.

4. The wave equation of time field-space

The potential-kinetic parameters of oscillations have the universal character and are applied to any potential-kinetic waves of matter-space-time. Relative measures $\hat{\psi}_r$ of all potential-kinetic parameters of harmonic oscillations of equal frequencies, expressed through amplitudes, are equal to the same ideal exponential function

$$\hat{\psi}_r = \hat{\psi} / a = e^{i\omega t}\,. \tag{4.1}$$

In this sense, all these measures are identical.

For the description of *waves* of different nature, the *wave spatial vector* **k**, related to the basis of wave, is used. It is determined by the equality

$$\mathbf{k} = (2\pi / \lambda)\mathbf{n} = (1/ƛ)\mathbf{n}\,, \tag{4.2}$$

where **n** is the unit vector directed along the wave extension, λ is the length of spatial wave, and $ƛ$ is the wave radius. We supplement **k**-vector with the analogous *wave time vector* **ω,** conjugated to **k**,

$$\boldsymbol{\omega} = (2\pi / T)\mathbf{n} = (1/t_m)\mathbf{n}\,. \tag{4.3}$$

Comparing the vectors, (4.2) and (4.3), we see that, at the level of basis of time waves, the period *T* is the *time wave* conjugated to the *space wave* ƛ.

The module of physical potential-kinetic time t_m (see (3.2)) is the radius of time circumference *T*

$$T = 2\pi t_m\,, \tag{4.4}$$

whereas in wave processes it is the wave time radius (compare λ and t_m in (4.2) and (4.3)). The vectors, **k** and **ω**, are connected through the equality:

$$\boldsymbol{\omega} = c\mathbf{k} = c_0 c_r \mathbf{k}\,, \tag{4.5}$$

where

$$c = c_0 c_r \tag{4.6}$$

is the basis wave speed,

$$c_0 = 1\ cm \times s^{-1} \tag{4.7}$$

is the unit speed, and c_r is the relative speed. Thus, the physical time of uniform motion, equivalent to the reference time, is contradictory: being the scalar magnitude it is simultaneously the vector magnitude.

For the description of the physical time field-space, we use the reference rectangular three-dimensional space of the absolute time. Namely, we present it by the frame of reference with the time axes T_x, T_y, and T_z. If a spatial wave beam of harmonic potential-kinetic oscillations $\hat{\Psi}$, with a constant amplitude *a*, is travelling along *x*-axis, then its equation has the form

$$\hat{\Psi} = ae^{i(\omega t - kx)}\,. \tag{4.8}$$

The following wave beam of harmonic potential-kinetic oscillations of time field $\hat{t}$ corresponds to it:

$$\hat{t} = t_m e^{i(\omega t - kx)}\,. \tag{4.9}$$

Harmonic beams with arbitrary constant amplitudes and equal frequencies are conjugated to the time wave beam of the same amplitude t_m. This amplitude is expressed through the amplitude of its own oscillatory speed, *i.e.*, the speed of superstructure. In view of this, the measure of amplitude of the time harmonic wave does not reflect the measure of amplitude of the conjugated spatial wave.

In order to make the time amplitude reflect the measure of spatial amplitude, we should introduce the *relative time amplitude* τ_m equal, by the definition, to the ratio of spatial amplitude *a* to the unit linear speed-density $c_0 = 1\ cm \times s^{-1}$:

$$\tau_m = \frac{a}{c_0}\,. \tag{4.10}$$

Now, we can accept, as the measure of time wave, the product of relative time amplitude τ_m by the relative measure of beam-wave $\hat{\psi}_r$:

$$\hat{\Psi}_m = \tau_m \hat{\psi}_r = \tau_m e^{i\omega t}\,. \tag{4.11}$$

If waves of the kind

$$\hat{\Psi} = \tau_m e^{i(\omega t - kr)} \tag{4.12}$$

arise along the three axes of Cartesian coordinates *x, y, z* , the following time three-dimensional wave field-space is formed

$$\hat{T} = \tau_{xm} e^{i(\omega_x t_x - k_x x)} \tau_{ym} e^{i(\omega_y t_y - k_y y)} \tau_{zm} e^{i(\omega_z t_z - k_z z)}, \tag{4.13}$$

where ω_x, ω_y, ω_z are components of the time wave vector **ω** and t_x, t_y, t_z are components of the vector of absolute time ***t***.

Fields-spaces of the structure (4.13) are *multiplicative* fields-spaces because spatial and time waves (components) in it are multiplicatively linked together. In other words, the principle of multiplicative superposition is valid for such fields. These are spaces-systems, or *atomic spaces* [3]. The sums of the multiplicative atomic fields-spaces form complicated fields-spaces, which can be called *molecular spaces*. These are *additive fields-spaces*, since the principle of additive superposition is valid for them.

The wave function $\hat{\Psi}$ of the three-dimensional wave field of physical time is the mathematical image-measure of the wave three-dimensional time space. The three-dimensional time wave is represented by its multiplicative components-waves:

$$\begin{aligned} \hat{\Psi}_x &= \tau_{xm} e^{i(\omega_x t_x - k_x x)}, \\ \hat{\Psi}_y &= \tau_{ym} e^{i(\omega_y t_y - k_y y)}, \\ \hat{\Psi}_z &= \tau_{zm} e^{i(\omega_z t_z - k_z z)}. \end{aligned} \tag{4.14}$$

Because

$$\boldsymbol{\omega t} = \omega_x t_x + \omega_y t_y + \omega_z t_z, \tag{4.15}$$

$\hat{T}$ -image of the three-dimensional wave (4.13) can be presented as

$$\hat{T} = \tau_{xm} \tau_{ym} \tau_{zm} e^{i(\omega t - k_x x - k_y y - k_z z)} \tag{4.16}$$

or

$$\hat{T} = T_m e^{i(\omega t - k_x x - k_y y - k_z z)}. \tag{4.17}$$

In a general case, the wave amplitude is variable and, in the wave stationary field, depends on coordinates, then we express it by the following way

$$\hat{T} = T_m(k_x x, k_y y, k_z z) e^{i(\omega t - k_x x - k_y y - k_z z)}. \tag{4.18}$$

Assuming that the amplitude T_m is a constant within the space of a material point, we have

$$\frac{\partial^2 \hat{T}}{\partial x^2} = -k_x^2 \hat{T}\,, \qquad \frac{\partial^2 \hat{T}}{\partial y^2} = -k_y^2 \hat{T}\,, \qquad \frac{\partial^2 \hat{T}}{\partial z^2} = -k_z^2 \hat{T} \tag{4.19}$$

and

$$\frac{\partial^2 \hat{T}}{\partial x^2} + \frac{\partial^2 \hat{T}}{\partial y^2} + \frac{\partial^2 \hat{T}}{\partial z^2} = -k^2 \hat{T}\,. \tag{4.20}$$

This equation can be also presented as

$$\frac{\partial^2 \hat{T}}{\partial (kx)^2} + \frac{\partial^2 \hat{T}}{\partial (ky)^2} + \frac{\partial^2 \hat{T}}{\partial (kz)^2} = -\hat{T} \tag{4.21}$$

or

$$\nabla_k \nabla_k \hat{T} = \Delta_k \hat{T} = -\hat{T}\,. \tag{4.22}$$

where ∇_k is the vector of negation of the time $\hat{\Psi}$-field and $\nabla_k \nabla_k$ is the operator of negation of negation, or the *operator of double negation.*

Thus, *the wave equation of time field-space* (4.22) *is one of the forms of the universal law of dialectics – the law of negation of negation, or double negation.*

Since

$$\frac{\partial^2 \hat{T}}{\partial (\omega t)^2} = -\hat{T} \tag{4.23}$$

or

$$\frac{\partial^2 \hat{T}}{\partial \tau^2} = -\hat{T}\,, \tag{4.24}$$

where $\tau = \omega t$ is the relative linear reference time, corresponding to the relative reference distance $\rho = kr$, the equation (4.22) can be presented in the following form

$$\frac{\partial^2 \hat{T}}{\partial \rho_x^2} + \frac{\partial^2 \hat{T}}{\partial \rho_y^2} + \frac{\partial^2 \hat{T}}{\partial \rho_z^2} = \frac{\partial^2 \hat{T}}{\partial \tau^2}\,. \tag{4.25}$$

This equation means the equality of time double and spatial double negations of $\hat{T}$-image of the physical wave time field-space. The wave equation (4.25) can be written as

$$\Delta \hat{T} = \frac{\partial^2 \hat{T}}{\partial \tau^2}\,. \tag{4.26}$$

On the language of dialectical logic, the equation (4.26) represents the laws of double spatial and double time negations:

$$\nabla_k^2 \hat{T} = \nabla_\tau^2 \hat{T} = -\hat{T}\,, \tag{4.27}$$

where

$$\nabla_k^2 = \Delta\,, \qquad \nabla_\tau^2 = \partial^2 / \partial \tau^2 \tag{4.28}$$

are the logical operators of double spatial and double time negations, correspondingly.

The physical wave time field-space is inseparable from the wave field of space of matter of the same structure, because the time wave $\hat{T}$ repeats the structure of spatial waves $\hat{\Psi}$ (compare $\Delta\hat{\Psi} = \partial^2\hat{\Psi}/\partial\tau^2$ with (4.26)).

5. Conclusion

Thus, the ideal mathematical time of the imaginary absolute uniform motion (absolute or reference time), commonly used in our life, is supplemented in dialectical physics with the physical (real) time. The latter, like any other measures characterizing the pure motion-rest, has the binary potential-kinetic character. The difference between the two times, reference and physical, is naturally revealed in dialectical physics.

The physical time wave field is an ideal field-space of the Universe. *Just physical time enters in the triad of matter-space-time*. For it description, the notions of the wave potential-kinetic time field and corresponding time potential-kinetic parameters were introduced. The wave time vector **ω** introduced (conjugated to the wave vector **k**) allowed considering the period *T* as the time wave conjugated to the spatial wave λ.

The wave function of the three-dimensional wave field of physical time, as the mathematical image-measure of the wave three-dimensional time space, satisfies the wave equation of time field-space. This equation reflects the universal law of dialectics – the law of double negation. The physical wave time field-space is inseparable from the wave field of space of matter of the same structure, because the time wave repeats the structure of spatial waves.

References

[1] Martin Heidegger, *The Concept of Time in the Science of History*, The journal of the British society for phenomenology, 1978, v. 9, No. 1. pp 3-10.

[2] L. Kreidik and G. Shpenkov, *Philosophy and the Language of Dialectics and the Algebra of Dialectical Judgements*, Proceedings of The Twentieth World Congress of Philosophy, Copley Place, Boston, Massachusetts, USA, 10-16 August, 1998; http://www.bu.edu/wcp/Papers/Logi/LogiShpe.htm

[3] L. Kreidik and G. Shpenkov, *Atomic Structure of Matter-Space*, Geo. S., Bydgoszcz, 2001, 584 p.

Lecture 10

Axioms of the Wave Model

1. Introduction

According to dialectics, the Universe is *material*, and at the same time it is an *ideal* system [1].

The observable and unobservable Universe is of *matter*. A material part of the Universe is all that surrounds us. This is not only an insignificant part what we see, perceive, and detect as particles and material objects composed of these particles, and as physical fields, but also a lot of all invisible mysterious existing at all levels of the multilevel infinite Universe. About them we know nothing because of inability to comprehend everything, naturally, owing to human’s limitations in perception of reality and a very low extent of civilizational and spiritual development, and hence owing to a relatively low (poor) level of human experimental means.

Really, a human physical body occupies one of the distinctive levels in the cosmic hierarchy, existing on the Earth in the close limits of strictly definite conditions (air, temperature, pressure, humidity, solar and cosmic radiation, *etc*.). This must be clear; the part of matter observable by man is only “the tip of the iceberg”.

Human, as the Universe, in his entirety is a *material-ideal* entity. A *material* constituent of human consists of a physical body (*dense matter*) and the energy field (*superfine matter*).

The human energy field, called the "*biofield*" or "*aura*", is a part of the energy field of the Universe. It is "*described as a luminous body that surrounds and interpenetrates the physical body, emits its own characteristic radiation …*". "*Based on their observations, researchers have created theoretical models that divide the aura into several layers. These layers are sometimes called bodies, and they interpenetrate and surround each other in successive layers. Each succeeding body is composed of finer substances and higher «vibrations» than the body that it surrounds and interpenetrates*" [2].

And what is *space* from the dialectical point of view? Our standpoint in relation to this notion is the following. *Space* is the notion that characterizes (and used for the description) just one of the basic properties of matter – the size and extension of material objects and fields, everything in the Universe. This is why we call it the *physical space*.

And what is *time*? It is the second of the basic properties of matter. We know that matter is in a continuous motion. Under the word "*motion*", one needs to understand not only pure mechanical movement, but also all changes of matter, in general. We mean, for example, chemical reactions, phenomena of radioactivity, intraatomic phenomena, multifarious processes of physical and chemical transformations in flora and fauna, *etc*. In all these cases, the notion of *time* serves as the universal measure for the description of the rate of all these changes and processes, embraced by the word "motion".

Thus, we realize that space and time separately as some entities, by themselves, do not exist. Hence, in a commonly used word combination (a triad) of *matter-space-time*, space and time represent the aforesaid properties of matter. Accordingly, the corresponding measures of mass, extension, and motion: the *gram* (*g*), the *centimeter (cm)*, and the *second* (*s*) are the objective unit measures of matter.

An *ideal part of the Universe* is of all that qualitatively diametrically opposite to matter. A universal ideal component of the Universe is the cosmic informational medium. For humans on the Earth, the dialectical field of binary numbers, as a part of the universal cosmic informational medium, relates to an ideal facet of the Universe. An information field of the Earth includes the knowledge stored in bodies of all people. The brain serves, first, as a converter of incoming information and transfers it to bodies for perception and memorizing. Second, it realizes interrelation (functioning) of man with the surrounding world providing a feeling of man as an individual in this word.

The Universe as a whole exists in continuous motion and this motion is not chaotic; it is subjected to a strictly defined rhythm, universal harmony, which regularities are conditioned by an existence of a universal ideal beginning (principle).

An *ideal* constituent of human is his spirit – mind, thinking, consciousness, intangible beginning (*e.g*., courage). The human brain plays a role of the link between the material and the ideal essence of man. A unity and harmony of macro and micro cosmoses, their interrelation and influence on each other is the law of the Universe. This feature gives the

base to state that the Universe represents a reasonable principle with peculiarities similar to those inherent in an ideal essence of human being mentioned above.

Atoms and „elementary" particles are regarded in Dialectical Physics as the structures of the distinct levels of the Universe, which has many such levels (*e.g*., galactic, stellar, planetary, molecular, atomic, subatomic, subelectronic, *etc*.). Therefore, it is clear; we should not consider atoms and elementary particles separately from the total structure of the Universe. This means that

> *when considering the problem on the structure of any material objects, one should begin from a precise definition of the principal axioms on the structure of the Universe on the whole*.

A universal axiom (single, real, and not questioned) of dialectical physics is *the axiom on the wave nature of all objects and phenomena in the Universe*. Such a brief presentation of the axiom reflects just its universal meaning. And now we will uncover a thorough content of this so compactly formulated axiom by specifying all particular facets hidden in it, in the verbal expression of the axiom – "*the wave nature of the Universe*". It makes sense to present this material here, at the end of Vol. 1 devoted to philosophical and mathematical aspects of dialectical physics, in order to show how the given axiom is used in practice; how it does work.

For this reason, we present below the unfolded variant of the aforenamed universal axiom in the form of, say, "secondary" or particular axioms which constitute the essence of the main one, universal. All these axioms collected together enter into the philosophical and mathematical basis of the dialectical Wave Model developed as an alternative to the modern Standard Model [1].

The material presented briefly here will be useful to getting an overview on the conceptual basis of the WM and its specific aspects, which, as was repeatedly mentioned above, has yielded the *key discovery*, revealing the *nature of mass and charge* of elementary particles.

2. The axioms of the structure of the Universe

2.1. The Universe is the Material-Ideal System with infinite series of levels of embedded potential-kinetic longitudinal-transversal fields of absolute-relative motion of matter-space-time, in which all processes occur simultaneously both at the same level ("horizontal" processes) and between levels ("vertical" processes).

2.2. Mutual transformations of fields with opposite properties (for example, the potential field → the kinetic field and the kinetic field → the potential field) cause the wave nature of the World. The wave process, appearing at some level, generates waves going deep into an

infinite series of embedded fields-spaces, and vice versa, wave processes of the exchange of deeper levels, rising up, induce wave processes at the higher lying levels.

2.3. Any object of the Universe at a k-level simultaneously belongs to a lower situated infinite series of embedded fields-spaces; therefore, the structure of megaobjects of the Universe is defined by the structure of their microobjects (and the microfields related to them of an infinite series).

2.4. Between objects, objects and the ambient field of matter-space-time, there exists an interchange of matter-space-time occurring both in horizontal (within the same level) and vertical (between different levels) directions.

2.5. The longitudinal-transversal structure of the wave field of exchange of the Universe of an arbitrary level is presented by the spherical-cylindrical wave field of matter-space-time.

3. The axioms of dialectical elementary judgments

3.1. The adequate description of the Universe is possible only on the basis of dialectical functions-judgments $\hat{\Psi}$ of the logical structure *Yes-No*:

$$\hat{\Psi} = Yes \cdot 1 + No \cdot i \qquad \text{or} \qquad \hat{\Psi} = Yes + iNo\,, \tag{1}$$

where 1 and *i* are the *units of qualitatively opposite properties*.

The first unit expresses a *unit judgment of affirmation;* the second unit – the *unit judgment of negation.* The unit of negation is simultaneously the unit of affirmation of an opposite property.

Measures of judgments *Yes* and *No* are defined by the measures of those polar opposite physical quantities of the same dimensionality, which describe the real properties of objects and fields of matter-space-time.

The dialectical judgment *Yes-No* is not the sum of *Yes* and *No*; it is a complex of judgments *Yes* and *No* and, in this sense, it is a complex judgment. Furthermore, we should understand the notion '*complex*' in this, and only in this, sense, not mixing it up with complex numbers of plane geometry and Riemann surfaces.

3.2. In a set of dialectical judgments *Yes* and *No*, describing opposite properties of matter-space-time, two different algebras of relations act between judgments.

The unit of affirmation follows the algebra of affirmation (*Yes-algebra*):

$$(\pm 1)(\pm 1) = +1\,, \qquad (\pm 1)(\mp 1) = -1\,. \tag{2}$$

The unit of negation follows the algebra of negation (*No*-algebra):

$$(\pm\mathrm{i})(\pm\mathrm{i}) = -1, \qquad (\pm\mathrm{i})(\mp\mathrm{i}) = +1. \qquad (3)$$

Here is an example of the realization of *Yes*-algebra. The repulsion of two charges of the same sign, ± 1 and ± 1, is expressed by the relative unit measure +1. Whereas charges of opposite signs, ± 1 and ∓ 1, attract to each other, and the measure –1 reflects this fact. This is the objective algebra of central, longitudinal fields of exchange of matter-space-time.

Here is an example of the realization of *No*-algebra. Currents of the same signs, $\pm i$ and $\pm i$, attract over their magnetic (transversal) fields. This attraction has the central character that is represented by the measure –1. Currents of different signs $\pm i$ and $\mp i$ repel, and that is represented by the measure +1.

3.3. An elementary dialectical judgment about wave processes is characterized by the wave measure of the numerical field of affirmation-negation of dialectics

$$\hat{\Psi} = \hat{\Psi}_m(kr)\hat{T}(\omega t) = \hat{\Psi}_m(\cos(\omega t - kr) + i\sin(\omega t - kr)), \qquad (4)$$

where $\hat{\Psi}_m(kr) = \hat{\Psi}_m \exp(-ikr)$ is the spatial wave and $\hat{T}(\omega t) = \cos\omega t + i\sin\omega t$ is the time wave of physical time, describing an elementary property of some wave field of space-time.

3.4. The geometry of a dialectical wave judgment repeats the geometry of real fields of matter-space-time. In particular, if the time component $\cos\omega t$ expresses the *potential* (*kinetic*) time, then, $i\sin\omega t$ describes the *kinetic* (*potential*) time wave field.

In other words, the *physical time field* is the *potential-kinetic time wave*, where the potential (or kinetic) component is $t_p = \cos\omega t$, and the kinetic (or potential) component of the wave of time is $t_k = \sin\omega t$.

The physical time wave field $\hat{T}(\omega t) = \cos\omega t + i\sin\omega t$ is a particular case of the complicated ideal time wave field-space of the Universe with an infinite series of levels.

4. The axioms of description of the physical objects and processes in space and time: axioms of the physical-mathematical ‘easel’

4.1. The easel of space is represented by the mathematical space of three measures with coordinates *x, y,* and *z*, which exist in our imagination and, therefore, has a subjective character. The subjective mathematical space *x, y, z* (in the form of the cylindrical space with

cylindrical coordinates ρ, φ, z and of the spherical space with spherical coordinates ρ, θ, φ) is the basis for the description of the corresponding physical fields-spaces.

4.2. The easel of time is represented by the subjective time *t* of absolutely uniform motion; therefore, the time flows uniformly and cannot be subjected to either dilation or contraction. This absolute, ideal time is the basis for description of the real objective wave field of physical time.

4.3. An axiom of reference measures and of the gram:

The reference units-measures of mass $\hat{M}$, physical space $\hat{S}$, and physical time $\hat{T}$ are represented, correspondingly, by the gram (*g*), the cubic centimeter (cm^3), and the second (*s*). Lines and surfaces of the physical space $\hat{S}$ are represented, correspondingly, by the linear centimeter (*cm*) and the centimeter squared (cm^2). The second squared (s^2) and the second cubed (s^3) describe surfaces and volumes of the field-space of physical wave time.

The level, on which measures of mass and volume of space, related to the mass (expressed in the reference units), are equal, we call the basis level. At the basis level, this equality takes place

$$\mathrm{M} = \varepsilon_0 \mathrm{V}, \qquad (5)$$

where $\varepsilon_0 = 1\, g \times cm^{-3}$ is the unit reference density. If the physical space of a basis level turns out to be embedded into itself ε_r times, we write

$$\mathrm{M} = \varepsilon_0 \varepsilon_\mathrm{r} \mathrm{V} = \varepsilon \mathrm{V}, \qquad (5a)$$

where $\varepsilon = \varepsilon_0 \varepsilon_r$ is the density, defined by the extent of embeddedness of space ε_r; then, the gram is the name of the unit of embeddedness of physical wave spaces. It means that if $\varepsilon_0 = 3\, g \times cm^{-3}$ then the extent of embeddedness of a physical space into itself is equal to 3.

4.4. An axiom of the natural physical measures:

The natural complicated measures of kinematic *K* and dynamic *D* physical quantities on the basis of reference measures-units are defined by the following dimensionalities

$$\dim K = cm^m \cdot s^n, \qquad \dim D = \varepsilon_0 \cdot cm^m \cdot s^n, \qquad (6)$$

where *m* and *n* are integer (and only integer) numbers; ε_0 is the unit reference density.

5. An axiom of change of fields of matter-space-time in time:

The comparative estimation of change of mass $\hat{M}$, physical space $\hat{S}$, and physical time $\hat{T}$ is defined by the ratio of the differential of the physical measure $\hat{\Xi}$ of matter, space, and time to the differential of the absolute mathematical time:

$$\hat{R}ate = \frac{d\hat{\Xi}}{dt}. \qquad (7)$$

In particular, if $\hat{\Xi} = \hat{V}$, then the ratio (7) defines the speed of change of physical wave space and the exchange of the space with the rate

$$q_0 \equiv \hat{R}ate_V = \frac{d\hat{V}}{dt}. \qquad (7a)$$

If $\hat{\Xi} = \hat{M}$, the ratio (7) defines the speed of change of the wave field of matter and the exchange of the wave field of matter (in particular, the mass of objects) with the rate

$$q \equiv \hat{R}ate_M = \frac{d\hat{M}}{dt}. \qquad (7b)$$

If $\hat{\Xi} = \hat{T}$, the ratio (7) defines the speed of change of the wave field of physical time with the rate

$$t \equiv \hat{R}ate_T = \frac{d\hat{T}}{dt}. \qquad (7c)$$

In the field of time, the exchange of time fields-spaces also takes place. The rates of exchange q and q_0, called the *charges of exchange*, describe interaction of a wave object with the field of matter-space-time and the interaction of objects among themselves.

6. The axioms of wave equations of the field of matter-space-time

6.1. A complicated dialectical judgment $\hat{\Psi}$, describing properties of fields of matter-space-time, satisfies the wave equation

$$\frac{\partial^2\hat{\Psi}}{\partial\rho_x^2} + \frac{\partial^2\hat{\Psi}}{\partial\rho_y^2} + \frac{\partial^2\hat{\Psi}}{\partial\rho_z^2} = \frac{\partial^2\hat{\Psi}}{\partial\tau^2}, \qquad (8)$$

where $\rho_x = kx$, $\rho_y = ky$, $\rho_z = kz$, *and* $\tau = \omega t$.

The equation describes both the spherical and cylindrical components of the function-judgment $\hat{\Psi}$ about the spherical-cylindrical field of matter-space-time of a level.

The spherical (longitudinal, central) component of the judgment, we present in the form:

$$\hat{\Psi} = \hat{R}_l(kr)\Theta_{l,m}(\theta)\hat{\Phi}_m(\varphi)\hat{T}(\omega t)\,. \qquad (8a)$$

Analogously, we express the cylindrical (transversal, azimuth) component of the judgment

$$\hat{\Psi} = \hat{R}_m(k_r r)\hat{Z}(k_z z)\hat{\Phi}_m(\varphi)\hat{T}(\omega t)\,. \qquad (8b)$$

6.2. The *longitudinal component* of the spherical-cylindrical field is described over a spherical realization of the wave equation (8), which comes to one time equation

$$\frac{d^2\hat{T}}{d\tau^2} = -\hat{T} \qquad (9)$$

and three equations of the spherical space:

$$\rho^2\frac{d^2\hat{R}_l}{d\rho^2} + 2\rho\frac{d\hat{R}_l}{d\rho} + \left(\rho^2 - l(l+1)\right)\hat{R}_l = 0\,, \qquad (9a)$$

$$\frac{d^2\Theta_{l,m}}{d\theta^2} + ctg\theta\frac{d\Theta_{l,m}}{d\theta} + \left(l(l+1) - \frac{m^2}{\sin^2\theta}\right)\Theta_{l,m} = 0\,, \qquad \frac{d^2\hat{\Phi}_m}{d\varphi^2} = -m^2\hat{\Phi}_m\,, \qquad (9b)$$

where $\rho = kr$.

6.3. The *transversal component* of the spherical-cylindrical field is described over a *cylindrical* realization of the wave equation (8), which comes to one time equation in the form (9) and three spatial equations:

$$\frac{d^2\hat{R}}{d(k_r r)^2} + \frac{1}{k_r r}\frac{d\hat{R}}{d(k_r r)} + \left(1 - \frac{m^2}{(k_r r)}\right)\hat{R} = 0\,,$$

$$\frac{d^2\hat{Z}}{d(k_z z)^2} = -\hat{Z}\,, \qquad \frac{d^2\hat{\Phi}_m}{d\varphi^2} = -m^2\hat{\Phi}_m\,. \qquad (10)$$

Aforementioned axioms of dialectical physics give us the possibility to describe objects and processes of nature by fully formed methods of wave physics, beyond quantum electrodynamics – the main theory of modern physics.

The wave nature of the Universe is reflected in the structure of elementary particles, which are dynamic, pulsing microobjects. We will proceed to describe them in the framework of the Dynamic Model of Elementary Particles and present unknown till now fundamental physical parameters originated from the model.

References

[1] L. Kreidik and G. Shpenkov, *Atomic Structure of Matter-Space*, Geo. S., Bydgoszcz, 2001, 584 p.

[2] B. A. Brennan, *Hands of Light*, Transworld Publishers Ltd, London/GB, 1993, 320 p.

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