



## Picture of the World in the context of the concept of motion

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### Concept of Motion

The world and everything associated with it are, to a first approximation, nothing but a material process. Material process is the dynamics (or, in the language of modern physics, energetics) of existence of both an individual material object or an ensemble thereof, and of the world as a whole. However, processuality occurs in a huge number of various forms. Each of these forms can be viewed as a mode of existence of either an individual object or of an ensemble thereof, or of a single integral system of objects. Processuality, which shows up in a certain particular form and thereby expresses the mode of existence of material objects, is actually what we call motion. Hence by motion we mean not the process itself, but the particular form of its occurrence, which expresses the corresponding mode of existence of material objects.

When motion is viewed as a form of existence of a process, consideration should be taken primarily of the history of the process proper, which manifests itself in various modifications. Given that no real process occurs on its own, but only in relation to a particular material object, the characterization of motion should also take into account the mode of association and relationships between the constituent components of the object (its structure) and the nature of the material medium (its substrate). Thus motion in the broadest and, we believe, in the most complete sense of the word, is nothing but the mode of existence of material objects, which consists in the nature of the manifestation of its processuality and its structural and substrate properties. All the above three characteristics may vary greatly and hence motion is infinitely variable and its diversity can be generally viewed as modification of the process[1].

Modification of the process is a continuous act of alterations in the existence of the object in relation either to its individual aspects (properties, dimensionality, configuration, location, etc.), or to its existence as an integral phenomenon. In this sense motion can be viewed as each and any change.

### Aristotle and F. Engels about the principal forms of motion

Aristotle was the first philosopher to analyze the concept of motion from this viewpoint. Based on his identification of four kinds of causes – substance, quality, quantity, and place – he for the first time provides a classification of the principal kinds of motion. He distinguishes two different kinds of change, one of which he associates with form – it is the process of the generation and destruction of things. He characterizes this kind of motion as a change in the essence of things. He associates the second kind of change with the quality, quantity, and place; he defines this kind of motion as the change of the state of things. It is important that Aristotle's classification of the kinds of motion is based on the mode of

manifestation of processuality: it is either the process of the generation and destruction of a thing, or the process of the change of one of its aspects (quality, quantity, or place). However, this classification of the kinds of motion ignores the structural and substrate aspects of material objects.

Among the philosophers of modern time it was F. Engels who viewed motion as a change in general. Based on the state of knowledge of his time (the second half of the 19 century), he proceeded from the understanding of what he considered to be elementary (and, apparently, primary) motion as a mechanical process, which in the course of the development of matter gradually evolved into increasingly complex forms of motion. He viewed the substrate base of material objects as the fundamental criterion of the evolution of the forms of motion. In accordance with the four kinds of substrate – atoms, molecules, living protein, and human society – he successively derived from mechanical motion another four basic forms of motion. These are the motion of: (1) atoms (physical form); (2) molecules (chemical form); (3) protein bodies (biological form), and, finally, (4) human activity (social form).

The approach of F. Engels has two advantages over the Aristotelian classification of the kinds of motion. First, Engels classifies the forms of motion in accordance with the substrate base of the material object. However, here we face an uncertainty concerning the mechanical form: it is unclear what substrate is directly associated with it. Second - and this point is very important - Aristotle classifies forms of motion from the perspective of the evolutionary principle: within the timeline of the transition from low to increasingly higher forms. However, F. Engels, while focusing his attention on the substrate, overlooked the processual aspect of motion, and in this sense his approach is inferior to that of Aristotle. There is an impression that in his classification Engels treats all forms of motion in terms of the same, namely mechanical, processuality, which only changes its form depending on the nature of the substrate. In Aristotelian approach, on the other hand, mechanical process is directly associated only with one kind of motion - relocation. In all other kinds of motion processuality shows up in its specific way. Thus, a qualitative change is a transition of opposite properties into each other; a quantitative change means the transition of something greater into something smaller or, on the contrary, of somewhat smaller into somewhat greater; a change of the form consists either in the generation or destruction of a thing. We thus see that Aristotelian classification of the kinds of motion is based on the gradation of the processual aspect of motion, whereas the classification of the forms of motion proposed by F. Engels is based on the gradation of the substrate base of material objects. As for the structural aspect of motion, it is absent in both the classification of Aristotle and in that of F. Engels.

On the physical nature of electromagnetic field

As we demonstrated above, motion is the unity of three aspects – the processual, structural, and substrate, - and hence it should be classified not in relation to a particular aspect, but in relation to all three aspects, and with due consideration of the specifics of their interrelation. However, at the same time, we follow the tradition established by the approach of F. Engels and believe that the classification should be: (1) performed in

accordance with the current level of scientific knowledge (modern science in our case), and, (2) methodologically based, like the classification of F. Engels, on the evolutionary principle.

Whereas in the time of F. Engels it was taken for granted that the primary form of motion was mechanical process, to adhere to such a view in our times would be a gross error[2]. For example, nuclear processes, which actually do not represent a form of spatial motion, but rather interconversion, generation, and destruction of particles, are more fundamental than mechanical process. Generally speaking, we believe that the classification of forms of matter should begin not with the definition of a primary process, but rather approach this issue from a much broader perspective, namely, from the concept of modern science about two opposite forms of substance – field and substance.

According to modern views, field and substance are antithetical primarily in two aspects. First, field, in contrast to substance, has no mass, i.e., in other words, whereas substance is at the same time in the state of rest and in the state of process, field has always one and only state – that of process. Second, all kinds of substance have clearly defined spatial boundaries and in this sense substance is considered to be a discrete form of matter, whereas field has infinite spatial extent. However, these differences, which follow from direct scientific observations of field and substance, concern only the external aspects of their manifestation. At the same time, science knows almost nothing about their essential difference, about the specific nature of the substrate base of each of these kinds of matter, nor it does know the specifics of the structure of each of these kinds of matter, or that of the process behavior in each of them.

In our book «Qualitative aspect of the world and its cognition» we tried to propose our own view of this problem. In particular, based on the well-known fact of the annihilation and birth of an electron and positron, we suggest a hypothesis about the peculiarities of the physical nature of electromagnetic field. We believe that in the process of their annihilation electron and positron do not disappear, but only acquire a qualitatively new mode of existence: their actual existence transforms into the mode of virtual existence. Conversely, the process of the birth of these particles involves the transition of their virtual existence into actual existence. In other words, we interpret the fact of annihilation and birth of an electron and positron not as a process of the destruction and birth of particles, but as a process of the transition of their existence from one mode into another: from actual into virtual existence (the process of annihilation) and, vice versa, from virtual into actual existence (the process of the birth of particles). From the above we make a remarkable conclusion about the physical nature of electromagnetic field – that it is simply the virtual existence of two elementary particles, an electron and a positron.

Our analysis of the virtual existence of the above particles gives us a certain idea about the mode of existence of electromagnetic field. Its substrate base is a virtual particle consisting of a mix of electron and positron ( $e^-e^+$ ). The relationship between electron and positron as two particles of identical mass and opposite electric charges forms the structure of electromagnetic field. The essence of virtuality consists in the realization of the process of mutual birth and destruction of an electron and a positron. A continuous cyclic change occurs that consists of contraction and scattering of each particle relative to each other:

while one of the particles contracts (i.e., so to speak, is born), the other particle scatters (in other words, is destroyed), but at the very peak of the act a change of the process occurs, when, on the contrary, the second particle contracts (is born), whereas the first particle scatters (is destroyed). The energy potential of each virtual particle is equal to two photon quanta ( $2h\nu$ ). On the whole, electromagnetic field is a uniform medium consisting of an infinite number of virtual particles made up of an electron-positron mix. This medium may be in two opposite states: either in the state of dynamic equilibrium, or, if subject to some external factors, in an excited state. The former state appears to be what is called the physical vacuum in quantum mechanics, and the observed cosmological phenomenon referred to by scientists as dark matter must be directly related to it. When subject to a weak influence, electromagnetic field emits radio signals. When acted upon by external energy equal to a photon quantum ( $h\nu$ ), light waves appear, and even stronger energy influence results in the emission of radioactive radiations of different power.

The virtual medium of electromagnetic field embraces the entire space and in this sense resembles what the 19 century scientists called the world ether. However, of the three fundamental properties purported to be inherent to ether – elasticity, universal pervasiveness, and absolute rest (staticity) – the virtual medium retains the former two while totally excluding the latter one, which is replaced by the opposite property of absolute processuality. Moreover, the virtual medium is also assumed to possess the fourth, structural property. In short, whereas ether was meant to be sort of a substrate devoid of processuality and structural properties, by the virtual medium of electromagnetic field is meant a well-defined physical body consisting of a mix of two elementary particles – electron and positron, which form a single integral structure and are in the state of a continuous process.

#### Weak interaction field and its physical nature

We thus view electromagnetic field as the primary form of matter, and its virtual process, as the primary mode of its existence. However, if we suppose that nothing else existed initially in the world then, according to the law of entropy, the field must have reached the state of absolute dynamic equilibrium, which would totally exclude the variety of now existing material forms, rendering the question about their evolution meaningless. We therefore have to assume that in the world there must initially have been, besides electromagnetic field, another, equally fundamental material basis external to electromagnetic field. We regard weak interaction field as such a basis.

Our idea of the mode of existence of the weak interaction field is based on the results of observations of the behavior of weak interaction performed by researchers. Weak interaction always involves such elementary particle as neutrino. It is also known from observations of neutrinos that this particle exists in two forms: neutrino and antineutrino, which have identical masses, but opposite spins and leptonic charges. It can be assumed, by analogy with electromagnetic field, that weak interaction field should also be a mixture of a particle and antiparticle – in this case, neutrino and antineutrino ( $\nu\bar{\nu}$ ). We further proceed from the empirically established fact of mutual transformation of neutrino into antineutrino and vice versa to conclude that the existence of these particles in the weak interaction field

is also virtual. However, unlike the virtuality of the particles of electromagnetic field, that of neutrinos and antineutrinos does not consist in their mutual birth and destruction, but in the continuous process of their mutual transformation into each other. Whereas the virtual process between electron and positron has the form of vibrations, the mutual transition between neutrino and antineutrino has the form of an oscillations.

This virtual peculiarity of the weak interaction field determines the specifics of its mode of existence as a whole. Unlike vibrations, which imply the existence of a continuous medium, oscillations occur between two solid bodies. It follows from this that the virtual particle of weak interaction field represents the interaction of two elastic point particles, which are absolutely singular (neutrino and antineutrino), and the field as such is nothing but an accumulation of a great number of these mutually oscillating particles. Weak interaction field is not a continuous medium permeating the entire world (which is characteristic for electromagnetic field), but, so to speak, a granular medium, where each virtual particle is an extremely pointwise and absolutely singular unity. These unities may accumulate over very different scales, up to forming isolated cosmic objects, but in all cases their existence is of local nature within certain spatial boundaries. It is quite possible that the so-called black holes observed in space are nothing but the cosmic formation of weak interaction field. The extremely strong gravity of these holes appears to be due to the fact that they consist of absolutely singular particles - neutrino and antineutrino - exclusively.

Thus, according to our concept, the initial form of matter consists of two physical fields – electromagnetic and weak – whose mode of existence is virtual. Note that both electromagnetic and weak interaction fields are capable of existing as autonomous cosmic objects. Examples of such an existence for electromagnetic and weak interaction field are the observed cosmic formation called the phenomenon of dark matter and black holes, respectively. However, these objects if considered per se are in all likelihood closed dynamic equilibrium systems, which means that their physical state is, if not completely then at least at the margin of absolute entropy. In our opinion, such cosmic formations can and must be considered as the initial physical basis for cosmic evolution. However, at the same time, they are by no means its initial stage. For the evolutionary process to start, these two opposite virtual forms of matter must start to interact with each other.

#### Quasar and the beginning of the evolution of substance

Scientists describe quasars as objects that optically resemble stars and spectroscopically, gaseous nebulae. The fundamental feature of quasars is that they have a wide range of spectra, which periodically vary with time giving these objects a great luminous variety. It has also been established that although, unlike stars, quasars have no clearly defined spherical shape, they have nevertheless a totally definite spatial form, and scientists have already found many hundreds of such objects.

According to the current concepts, initial substance is born inside quasars in the form of elementary particles. As a result of the interaction of electromagnetic and weak fields, a metamorphosis involving their virtual particles occurs. Because of the different nature of the two processes – vibratory process of electromagnetic field and oscillatory process of the weak interaction field – the components of virtual particles regroup so that electron (e-) and

positron ( $e^+$ ) «absorb» antineutrino ( $\bar{\nu}$ ) and neutrino ( $\nu$ ), respectively, to form two new pairs: electron-antineutrino ( $e-\bar{\nu}$ ) and positron-neutrino ( $e^+\nu$ ). Such a pairing is determined by the relation of charges: electric charge of electron and positron and leptonic charge of neutrino and antineutrino. Negative electric charge of the electron attracts positive leptonic charge of the antineutrino and repulses negative leptonic charge of the neutrino. On the other hand, positive electric charge of the positron attracts negative leptonic charge of the neutrino and repulses positive leptonic charge of the antineutrino.

The newly formed substrate is rather unusual, it is intermediate between field and substance, because it is not a totally actual particle, but at the same time it cannot be considered a virtual particle any more. We call this uncertain substrate state by the term “quark” ( $q$ ), which is widely used in modern physics. This substrate is the first thing that possesses such a fundamental property of matter as mass, which expresses the state of rest. However, it is important that this state of quarks is their absolute characteristic. The point is that in the case of the synthesis of two particles with equal energy potential ( $h\nu$  or  $mc^2$ ), but with opposite charges of different nature, they find themselves in the state of absolute lock, i.e., in the state of static equilibrium or, which is the same, in the state of absolute rest. To somehow distinguish two kinds of quarks, we call the one with positive electric charge positive quark or simply quark ( $e^+\nu$  or  $q^+$ ), and the one with negative electric charge, negative quark or antiquark ( $e-\bar{\nu}$  or  $q^-$ ).

Quarks are in the state of absolute rest and are thereby totally devoid of internal dynamism and absolutely unstable, and hence cannot exist on their own and begin immediately to interact with their surrounding virtual particles. As a result, a new – the third – state of the substrate forms. It is actual substance, which initially has the form of elementary particles. The first such particles to appear are positive and negative pi-mesons ( $q^+\bar{u}\bar{u}$  and  $q^-\bar{u}\bar{u}$ ), followed by neutron and antineutron ( $e^+\bar{u}\bar{u}e^-$  or  $q^+q^-q^+$  and  $e-\bar{u}\bar{u}e^+$  or  $q^-q^-q^-$ ), then by proton and antiproton ( $q^+\bar{u}\bar{u}q^+$  and  $q^-\bar{u}\bar{u}q^-$ ) and, finally, by atomic nucleus and antinucleus, which, in turn, consist of nuclei ( $q^+\bar{u}q^+\bar{u}q^+$  and  $q^-uq^-uq^-$  for atomic nucleus and antinucleus, respectively) and, moreover, they are both surrounded by the same envelope – the virtual particle of electromagnetic field ( $e-e^+$ )[3].

All the processes associated with the formation of quarks and of the first elementary particles occur inside the quasar, and the quasar itself is nothing but the initial material formation in cosmos. Given that particles and antiparticles form simultaneously in the quasar, when colliding with each other they break again into the virtual particles of the fields and everything repeats again and this cycle may continue infinitely. Quasar light variations appear to be due to the complex process of synthesis and decay of elementary particles of different nature that occurs in its interiors and results simultaneously in the absorption and release of enormous energy. Energy is absorbed during the birth of particles and released during their decay, and if the quasar is a closed system, these processes are balanced by each other and thereby ensure stable existence of the quasar.

However, a quasar, being bounded in space, has, like any other finite final product, a center (the core) and periphery (the envelope). The phenomenon of strong redshift that researchers observe in quasars must be indicative of the change of oscillatory process from

high frequencies at the center to appreciably lower frequencies at the periphery. In other words, the processual activity of the quasar gradually decreases from the center toward the periphery, and we consider such a behavior to be the main condition for further progressive development in the formation of matter. If the energy processes at the periphery occurred with the same intensity as at the center, there would be only quasars, dark matter, and black holes in the world, and there would be not only no life and intelligence, but even no hydrogen nebulae, stars, planetary systems, etc.

As we mentioned above, the last particles in the chain of formation of matter inside the quasar are atomic nuclei. In the central part of the quasar oppositely charged nuclei (a nucleus and antinucleus) immediately interact with each other and decay, like peas, into virtual particles of fields. The slow processual activity in the peripheral part of the quasar allows nuclei to exist for some time on their own, and this time is sufficient for the nuclei to enter into contact with virtual particles of electromagnetic field located outside the quasar. When subject to a strong electromagnetic influence by quasar nuclei, virtual particles ( $e^-e^+$ ), decay into individual electrons ( $e^-$ ) and positrons ( $e^+$ ). This is how electron and positron are born for the first time. Once born, they immediately become capable of translational displacement, but, when subject to the strong energy influence of the nuclei, they cannot escape from these nuclei and therefore immediately enter into interaction with them to produce the first atoms – those of hydrogen and antihydrogen. Positive nucleus combines with an electron to produce hydrogen, whereas a negative nucleus combines with an electron to produce antihydrogen. Since that time a qualitatively new stage in the development of matter begins – that of the formation of atoms, molecules, cosmic nebulae, stars, galaxies, etc.

Overall conclusion about the picture of the world and the beginning of the evolution of substance

According to our ideas, the initial condition for the existence of matter is neither the inertial state of substance, as it was commonly supposed in Newtonian classical mechanics, nor, as the Big Bang theory implies, the state of absolute singularity of substance concentrated at a single point. It is rather the state of virtuality of two physical fields – electromagnetic and weak. Or, in other words, the initial existence of matter does not manifest itself in the form of actual substance, but in the form of fields whose physical substrate constitutes virtual substance. The initial mode of existence of both the fields and the initial actual substance (elementary particles) is not the mechanical process by itself, as it has been generally hitherto believed, but an oscillatory process accompanied by the synthesis and decay of particles. Note that the synthesis and decay of such elementary particles as electron and positron on the one hand, and neutrino and antineutrino, on the other hand, which constitute the virtual state of electromagnetic and weak interaction field in the former and latter case, respectively, are the initial mode of existence of matter as such.

A picture of the world thereby emerges in the form of a model where the Universe is based on two virtual particles, each of which consists of two pairs of leptons: electron—positron and neutrino-antineutrino. The former pair (electron-positron) constitutes the

substrate basis of electromagnetic field, which is nothing but the world ether that fills the entire world universum and serves as the background for the entire variety of processes existing in the world. According to this model, the “physical vacuum” of modern physics is the state of electromagnetic field where its virtual particles are in dynamic equilibrium. The same state also appears to be the manifestation of what the researchers call the “dark matter”. The latter pair (neutrino-antineutrino) constitutes the substrate basis of the weak interaction field, however, it does not fill the entire space, but forms islands in the Universe, and these very islands must be nothing but the so-called black holes. According to this model, the elementary particles neutrino and antineutrino are point expressions of the singularity (extreme density) of substance in the Universe. This extreme density appears to explain the unique capability of the forces of gravity characteristic for black holes.

As for the process of the evolution of substance, it begins at the time when two virtual particles of different nature – electron-positron, on the one hand, and neutrino-antineutrino, on the other hand – collide to produce quarks. Based on the latter, elementary particles are born, namely, first hadrons in the form of mesons, neutrons, protons, etc., the structure of particles becomes increasingly complex and the process has the properties of a cycle. We suggested that the above particles are born in quasar interiors. In all likelihood, the same process occurs in the interiors of all stars without exception, and in Sun-like stars hadrons should form in the central part. As for the birth of isolated leptones like electron and positron, they form not in quasars or stars, but at the boundary of existence of these cosmic objects and their surrounding electromagnetic field. Further evolution of substance – formation of atoms, molecules, etc., – is associated with the emergence of isolated electron and positron.

[1] I analyze in detail motion as a modification of the process in my book «Qualitative aspect of the world and its cognition», where I consider the process itself as the initially absolute mode of existence of the world (see: Arlychev, A.N. Kachestvennyi aspekt mira i ego poznanie (Qualitative aspect of the world and its cognition). Moscow, 2001. P. 138-277 (in Russian)).

[2] However, the view of the initial motion as a mechanical process still persists in the minds of many researchers. For example, it is the basis of modern cosmological model of expanding Universe and the so-called Big Bang theory based on it. For a detailed criticism of these views, see Arlychev A.N. Formal’no-mekhanisticheskaya model’ Vselennoi: mif i real’nost’. (Formally mechanical model of the Universe: myth and reality) (in Russian) // «Filosofskie issledovaniya », 2006, No. 3-4. P. 13-42.

[3] For a detailed discussion of this issue see *ibid.* P. 188-199.

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