The Newest Development of Quantum Electrodynamics: Electron as an Open Self-Organizing System, Superluminal Signals, Dynamical Properties of Time

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> "…it is necessary to periodically subject to the deepest revision the principles, which were recognized as final and were no longer discussed".
>
> Louis de Broglie

Abstract. The results of an approach based on the synthesis of standard quantum electrodynamics and of the ideas of self-organization in physical systems are briefly outlined. The quantum model of electron as an open self-organizing system is constructed, with the physical mechanism of self-organization consisting in the back influence of the own field created by electron on the same electron. The own field is considered as a physical property of electron, intrinsically inherent in electrically charged matter, which is included in the definition of the particle from the very beginning. The own field of electron endows the particle with wave properties and represents a bearer of superluminal signals, which can be used for the creation of qualitatively new communication systems. Because of the inseparable link between space and time, the force in relativistic mechanics is the cause of change not only of the velocity of particle, but also of the course of time along the particle's trajectory. For this reason the flow of time in some area of space depends on the character of physical processes, occurring in it, and, therefore, time can be controlled by slowing down or accelerating its course with the help of material processes. The conclusions of the paper are not in conflict with the special theory of relativity (STR); they are a direct consequence of relativistic equations of motion and represent an essential development of the generally accepted notions about space and time. **At present all the necessary prerequisites are available, both theoretical and technical, for the practical mastering of the own fields of particles and of the physical properties of time.**

1. Introduction. The Problem of Electron and Future Outlook

Electrodynamics, what is this? What is its value for man? Electrodynamics is the theory of electromagnetic interaction, one of four interactions existing in nature. Its role in the life of society is seen from the fact that the most part of natural phenomena, which we encounter at every step, is of electromagnetic origin: it is due to the interaction of electromagnetic field with electrically charged particles entering into atoms and molecules. It is fair to say that electromagnetism plays a crucial role in the life of mankind as it determines the ways of technical advance of society [1].

The key problem of quantum electrodynamics is the problem of electron, which can be formulated as follows: to construct from the first principles a non-contradictory model of electron, which takes into account experimental facts, i.e. to find the dynamical equation capable of describing

the unique physical properties of electron, its internal structure, its behaviour when it interacts with electromagnetic field.

Electron was discovered a little more than 100 years ago, in 1897. With discovering the electron the revolution in physics began, which has resulted in unprecedented technical advance of society. The summit of development was reached in the middle of the 1950s and then the long period of evolutional development followed, when new physical principles were used to describe various physical processes and phenomena. The violent development of physics became slower in the 1970s and was replaced by stagnation in the subsequent years. The stagnation in electrodynamics continuing already over a period of several decades is gradually giving place now to a new ascent. The new scientific revolution is starting, which is associated with electron again, much as it happened hundred years ago. The reason is that electron is the most unique particle storing in itself the deepest mysteries of nature and the degree, to which they are disclosed, determines the technological level of development of society. The gist of the processes taking place in science during the period, when the overwhelming majority of explorers sincerely trusts in the verity and finality of the generally accepted system of views about nature, is expressed well enough by the known historian L. Gumiljev in the following words: "The End and the Beginning again". Those views and conceptions that appear to the majority of specialists as the final truth, as the summit of development, prove to be merely a completion of some stage of development, the beginning of a new, difficult ascension leading to a radical change in the conventional views and conceptions.

An analysis of the newest development of quantum electrodynamics demonstrates that we are on the threshold of revolution in engineering. Already now, when one is at the very beginning of the new ascension, it is possible to indicate with certainty the following trends of development in engineering in the 21st century.

Firstly, **there will be created the essentially new means and systems of communication working on superluminal signals whose bearers are the own fields of material bodies**. By their physical characteristics – by the speed and range of information transfer, by the capacity to penetrate through obstacles, by their reliability in service - the new communications facilities will be much superior to the now existing ones. As is known, within almost hundred years superluminal signals were tabooed in physics and everyone was confident that such signals cannot exist in nature. The special theory of relativity (STR) imposes a prohibition on the motion of material bodies with the speed exceeding that of light in vacuum, but, as is shown in our papers, does not prohibit superluminal signals whose existence follows directly from the Maxwell equations. It appears, moreover, that superluminal signals are the most important element of structural organization of the world, which provides its stability. At present there are everything required for the practical mastering of the own fields of particles and for the creation of electronic devices and technologies using superluminal signals. The devices and the technologies indicated above will find various applications in many areas of science and engineering and, in particular, in medicine. With their creation the medicine will have an opportunity to investigate in detail the energetical body of a person (energetical shells, biofield, aura). It will give a potent impulse to the development of alternative (nontraditional) medicine as the most effective methods of medical treatment of men.

Secondly, **the physical properties of time**, whose existence was indicated by N. Kozyrev almost half a century ago, **will be used for practical purposes**. According to Kozyrev, time is of an active nature, the events not only exist in time, but also take place with its participation. We managed to show that the Kozyrev hypothesis is a direct consequence of relativistic mechanics. The existence of the physical properties of time is manifested in that the course of time in some material system depends on the nature of physical processes going on in it. This means that the physical properties of time are of

dynamical origin. This fact is of considerable importance since it indicates that it is possible, on the one hand, to control the course of time in some area of space with the help of electronic processes and, on the other, to influence the behaviour of a physical system by changing the course of time in it.

In this paper the results of investigations on the problem of electron are briefly outlined carried out by the author and his colleagues for the last years and published in the monograph [2].

2. Self-organizing electron

The standard formulation of QED proceeds from the assumption that electron is a structureless point particle. This assumption results in a serious difficulty – the divergence of the self-energy of electron. One more difficulty of the conventional approach is that quantum mechanics is unable to explain stability of the point-like electron. Really, the wave packets, which could have a claim on the role of the wave functions describing the behaviour of a free point-like electron, spread out in time, which contradicts the experimental fact of stability of the particle.

The difficulties mentioned above are very serious. According to Dirac, the difficulties of QED "in view of their fundamental character can be eliminated only by the radical change of the foundations of theory, probably, radical to the same extent as transition from the Bohr orbits theory to modern quantum mechanics" ([3], p.403). “Correct conclusion is that the basic equations are erroneous. They should be changed in such a way that divergences do not appear at all”. As an analysis of the problem shows, one should abandon all attempts at using the notion of point-like electron and should take into account that the self-action of electron is the key to constructing a consistent quantum model of the particle.

One of the boldest ideas concerning the physical nature of electron belongs to E. Schrödinger who suggested the historically first physical interpretation of quantum mechanics. According to Schrödinger’s hypothesis, the quantity $e\left|\Psi(\boldsymbol{r})\right|^2$ is the density of spatial distribution of electron’s charge (e and $\Psi(\boldsymbol{r})$ are the charge and the wave function of electron, respectively) and thus the dimensions of electron are the same as those of atom [4,5]. However, the attempts to substantiate this interpretation failed and, for this reason, Schrödinger’s idea was rejected by the majority of physicists [6].

The interest in Schrödinger’s interpretation has been revived during the last few decades in connection with the new approaches to calculation of radiative corrections [7-9]. A. Barut and his collaborators formulated and developed the quantum theory of electromagnetic processes based entirely on the self-energy picture (the Self-Field QED). As is pointed out by Barut [7], “the correct quantum equation of motion for the radiating electron is not the Dirac or the Schrödinger equation for a bare electron, but an equation containing an additional non-linear self-energy term”.

New lines of approach to the problem of electron are proposed in [2,10-15]. The approach represents a synthesis of conventional quantum electrodynamics and the ideas of the theory of self-organization in physical systems [16]. The physical mechanism of self-organization consists in the back action of the own field created by charged particle upon the same particle. It is described by the model of open system with the wave function belonging to indefinite metric space.

The essence of the approach developed is that the own field of electron is considered as a physical property intrinsically inherent in the particle and, when formulating the theory, the own field is included in the definition of electron from the very beginning. This means that we adopt as zero approximation not a “bare” electron, but an electron capable to create the own field and to “feel” its back influence.

Mathematically, taking into account the back action of the own field created by particle upon the same particle results in the non-linearity of dynamical equation describing the behaviour of electron. Thus, electron becomes a ***self-organizing system***, whose physical properties, geometrical shape, and linear dimensions may be determined in a self-consistent way from solutions of the basic dynamical equation. Electron is a quantum (elementary excitation) of the field of charged matter localized in a bounded region of space and subject to the Coulomb self-action.

Since electron represents a clot of electrically charged matter, creating the long-range Coulomb forces in surroundings, its environment turns into a medium, which can have a determining influence on physical properties of the particle. In view of the long-range character of the Coulomb field, electron becomes ***an open system*** inseparably bound with the environment. In a sense the whole universe takes part in the formation of electron as a physical system.

The own field responsible for transformation of electron to an open self-organizing physical system can be imagined as a web of electric lines of force emerging from the particle and of magnetic ones enclosing the particle. All the bodies in the Universe are shrouded in the web and as a result the surrounding space and the time as well are endowed with physical properties.

Obviously, to describe electron as an open system one should introduce into quantum mechanics a radically new point, namely: one should replace the model of isolated system described by harmonic oscillator, which is at the heart of modern physics, with the model of open system. It is pertinent to note here that the theory of quantum particles based on the use of the models of isolated system is, strictly speaking, physically meaningless. Really, any observation conducted on a system represents a process of interaction of the system with the means of observation. In the case of microparticles (quantum particles) this interaction is not weak, and consequently it is inadmissible to neglect it, i.e. the microparticles should be necessarily considered as open systems.

As open system has the richer physical contents in comparison with isolated system, the essentially new mathematical ideas are needed for such a system to be described. To take into account that real electron, being considered as an open system, is inseparably linked with surrounding medium, we should first of all increase the number of dynamical variables describing it. Really, real electron can be imagined as a system consisting of two components: one of them should correspond, in a sense, to the particle alone (to the “bare” particle) and the other to the surrounding medium, in which the particle moves. Therefore, in the simplest model of open system one should double the number of dynamical variables. To each dynamical variable of the “bare” particle there should correspond two dynamical variables, which should be considered as components of the wave function describing the quantum state of particle. Besides, the system under study should be subordinated to a condition for openness expressing the fact that real electron is indissolubly bound to environment and its interaction with environment cannot be weak. The condition for openness can be formulated as follows: the open system should make sense only in the event that there are simultaneously both components – the particle alone and the environment, and these components should be equivalent.

From the action principle, the basic dynamical equation is derived taking into account the relativity principle and describing the self-acting electron as an open self-organizing system [11-15]. By its appearance this equation coincides with the usual Dirac equation for a charged particle in an external field described by 4-potential. However, in reality, it differs essentially from Dirac’s equation. The distinction consists in that the equation derived is non-linear and non-local, with the non-locality being of spatial and temporal character.

It should be noted that the potential and vortex components of the 4-potential entering into the dynamical equation differ from each other by their physical nature: the first describes the own field and is expressed in terms of the wave function components of electron, and the second describes the vortex

electromagnetic field and is uniquely determined by the electromagnetic field variables. From the formal point of view, the content of the QED formulation developed here is that these two essentially different quantities are integrated into a single 4-vector.

As a detailed analysis shows, solutions to the basic dynamical equation of electron describe the clots of self-acting electrically charged matter, localized in space, i.e. electron is a soliton. The self-acting electron can be in different quantum states characterized by internal energy, dimensions, and geometric shape. The internal energy spectrum of electron is discrete with an infinitely large number of levels. To each value of internal energy there correspond certain linear dimensions and geometric shape of the region of localization of electron's charge. Dimensions and the number of extrema of wave function increase with increasing the value of internal energy.

The distribution of electric charge of electron in the ground state consists of the range of basic localization with the linear dimensions of the order of Bohr radius a_0 $(a_0 \sim 10^{-10}\, m)$ and of the tail stretching up to infinity. Owing to the non-linearity of the dynamical equation of electron, the wave function does not obey the superposition principle. In virtue of this electron acquires the properties of absolutely rigid body: the perturbation acting on electron at an instant t in the range of basic localization becomes known at the next instant $t+\varepsilon$ $(\varepsilon \to +0)$ at any distance from it.

3. The Own Field of Charged Particle

According to the generally accepted point of view, the velocity of light in vacuum is the greatest possible velocity of transfer of a signal existing in nature. This conclusion was formulated by A. Einstein as a consequence of the special theory of relativity (STR) as follows: "... There is no way of sending the signals which would propagate faster than light in vacuum " (see [17], p. 157). At the same time the astronomical observations conducted by N.A. Kozyrev and others [18-20] have shown that there exists in nature some mechanism of action-at-a-distance of one body on the other resulting in the superluminal transfer of a signal.

An attempt to find in electrodynamics the physical mechanism of superluminal transfer of information is undertaken in [21]. It is noted here that **the physical bearer of superluminal signals is the own field of an electrically charged particle**. This field is of a dual nature: on the one hand, the own field is governed by the Maxwell equations and consequently it is an electromagnetic field and, on the other, it is created by a charged particle and cannot exist when the particle is absent, i.e. it represents in some sense a constituent part of the particle. It is not surprising that the own field of particle considerably differs by its physical properties from the field of electromagnetic waves: it is of a purely classical character and cannot be reduced to the set of photons. The own field seems to be responsible for the wave properties of particle, which are manifested in experiments on diffraction of electrons. The function of the own field of a charged particle is to transform the environmental space to a physical medium with the properties of an absolutely solid body. One of the physical properties of this medium is that it is capable of transferring a signal, connected with a perturbation occurring at some point of space, instantaneously to arbitrarily large distances.

According to [21,22], **the transverse vortex electromagnetic field consists of two components** significantly different from each other by their physical characteristics - **the electromagnetic waves and the own field of charged particles**. To these components of electromagnetic field there correspond two mechanisms of transferring a signal (information): (1) the instantaneous transfer of a signal via the own field of charged particles, representing the standing waves of matter rigidly linked with particles and going from them to infinity or to other particles, the own field being capable of transferring a perturbation both with the speed of light and instantaneously; and

(2) the transfer of a signal with the speed of light by means of electromagnetic waves, which are emitted by particles when they move with acceleration and then separate from the particles. It should be stressed that both mechanisms of transferring information mentioned above work simultaneously as though duplicating each other.

The existence of instantaneous signals necessarily follows from both the laws of electrodynamics and the most general considerations. As the own field of electron is inseparable from the particle, electron and its own field should be considered as a single physical system. In view of the long-range character of the own field, this system fills in the whole space. In order for such a system to be stable, a physical mechanism should exist combining its parts into a unit. The instantaneous transfer of information via the potential and vortex components of the own field of electron is, apparently, such a mechanism. By other words, the instantaneous signals are indissolubly related to the processes of self-organization, resulting in formation of the internal structure of charged particles.

To specify the physical mechanism of superluminal transfer of information, let us turn to the quantum theory taking into account self-action. According to [11-15], electron represents a soliton - a clot of electrically charged matter having the physical properties of absolutely solid body (because of the violation of superposition principle). It is a complicated dynamical system consisting of a region of basic localization, with the sizes being of the order of Bohr radius for the ground state of particle, of a tail, extending up to infinity, and of the own field. The presence of the tail manifests itself in that the charge density of the self-acting electron proves to be distinct from zero (though rather small in magnitude) far outside the region of basic localization of particle. The oscillations of the charge density, occurring in this region, are instantaneously transferred along the tail via the own field of particle to any distances and excite the oscillations of electric and magnetic fields at each point of space. This process ensures that information about a physical event occurring at some point of space can be gained immediately from a measurement conducted at any place of the universe. It should be noted that the effect is absent for a point-like particle.

As is known, the presence of an environment capable of transferring an oscillation from one point of space to the other is a necessary condition for the existence of waves. For electromagnetic waves, such an environment is, apparently, the own field of particle. The latter is similar to the elastic strings that bind electric charges to the environmental medium and endow it with properties of an absolutely solid body. These strings are inseparable from the charged particle, they are not of photon structure and consequently they cannot be destroyed without destroying the particle, with which they are connected. When a charged particle moves with acceleration, a photon field is split out of its own field, the vortex own field of the particle being deformed and losing its axial symmetry.

Generally, the own field of particle contains four components according to the four now known types of interaction - electromagnetic, weak, strong, and gravitational. Each of these components is a classical field linking the particle to the surrounding world via superluminal signals.

The inference about the possibility of superluminal transfer of a signal with the help of self-field of charged particles is in the obvious contradiction with the standard point of view, which for the first time was formulated by A. Einstein as a consequence of the special theory of relativity [17]. A detailed analysis of the problem shows, however, that our conclusion is in agreement with STR. The standard point of view is true only at first sight; it cannot be proved within the framework of STR. As is obvious from the analysis of the superluminal excitation transfer through the own field of particle [21,22], the statement that the transfer of signals with faster-than-light speed is impossible is in essence an additional postulate contradicting Maxwell's equations.

The generally accepted standard proof that superluminal signals cannot exist in nature is erroneous. The fallacy in the proof consists in that the causal relationship between two events is

analyzed within the framework of kinematics without using the equations of motion. The causality problem is, however, a problem of dynamics, because the case in point is the transfer of interaction from one event to the other. Hence, it can be solved only by the analysis of solutions of dynamical equations subordinated to proper boundary conditions. Remaining in the framework of kinematics, it is impossible in principle to solve the causality problem. In the generally accepted reasoning relating to superluminal signals, dynamics is not considered at all and consequently the conclusion about impossibility of superluminal signals is not justified.

In [22] the phenomenon of relativity of physical processes caused by superluminal signals is predicted. The heart of the phenomenon is that the points of view of two observers situated in the different inertial frames of reference on an event, occurring at some space-time point, can be essentially different. The effect is a result of peculiarities of the space-time geometry, which are manifested in the presence of superluminal signals. The phenomenon has its origin in the fact that some space-time barriers can be formed in the 4-dimensional space, which are capable to hide for a while a part of information on physical process.

4. Physical Properties of Time

Time is among the most common concepts, which are used permanently both in science and in everyday life. This is because all events and processes in the world happen in space and develop in time and, hence, the laws that govern space-time connections are the most general and hold for all forms of matter. From the point of view of common sense, time characterizes the duration of events and processes and indicates their natural sequence, at which the present, going away to the past, is replaced by the future.

I. Newton gave a clear-cut characteristic of the concept of time, to which the majority of physicists adheres: "The absolute, true, and mathematical time in itself and by virtue of its nature flows uniformly and regardless to any other object …". Though, according to Newton, time flows equally and uniformly and does not depend on the processes, occurring in the world, the daily experience favours the opinion that the course of time is not uniform. Depending on circumstances in our history, it seems to us that time either flies swiftly or hangs heavy on our hands; sometimes it even changes by leaps. There are a lot of poetic images indicative of the non-uniform, uneven flowing of time: "the minutes fatal" (A. Pushkin), "the instants of life" (V. Brjusov), and "starry hours of mankind" (S. Zweig). The minutes of inspiration familiar to the people engaged in creative work may also serve as an example of a sudden change in the course of time when the problems, which did not yield to solution for a long time, are suddenly solved in a flash. These are the rare moments of truth exciting and unforgettable. In connection with these speculations the question arises: Whether the subjective sensations of non-uniformity in the course of time familiar to everyone have an objective basis?

In Newtonian mechanics time is of an absolute character, it does not change as one passes from one inertial reference frame to another and represents merely a parameter, the change of which at the will of explorer results in the change of state of a mechanical system in accordance with the equation of motion.

In relativistic mechanics time remains a parameter describing the development of system. Now, however, time and space are intimately linked with each other to form a single whole – the 4-dimensional space-time. In going from one inertial frame of reference to another, time gets entangled with spatial coordinates, so that time in one reference frame represents a "mixture" of time and coordinates in the other. Time ceases to be universal, the same in all inertial reference frames; it takes on a relative character. This circumstance, combined with the conception of physical field, results in the

fact that time now gains a new quality, which was not available in classical mechanics: it becomes a bearer of physical properties. This point, in view of its fundamental importance, deserves some more discussion.

According to the conception of physical field, which was called by Einstein the most important discovery in physics after the times of Newton, if a body generates in surrounding space a force field, the space turns into a physical medium, which is capable to interact directly with other bodies and gains, thus, physical properties, becoming an active participant of physical processes. In view of the fact that space and time are indissolubly related to each other, the presence of a force field in space must necessarily result in the appearance of physical properties of time caused by the motion of a body in this field.

Thus, from the synthesis of the notion of space-time and of the idea of physical field it follows with necessity that the course of time in a given area of space should depend on physical processes in this area, i.e. time, as well as space, should have physical properties.

It should be emphasized that in STR time and spatial coordinates are independent and formally equal in rights quantities, which determine the position of elementary events in space-time. On the other hand, time stands out in relation to spatial coordinates. The special role of time is due, from the viewpoint of geometry, to the pseudoeuclidity of geometry of the 4-dimensional space. From the physical point of view, it is associated with the dynamical principle (causality principle), according to which the state of motion of a physical system at an instant of time t uniquely defines its behaviour at the following instant of time $t+0$. The significance of dynamical principle lies in the fact that it relates the temporal evolution of system to the physical processes caused by force fields and in doing so it allows one to determine the course of time in the system, its possible dependence upon the character of physical processes, and not just the sequence of events and their duration.

The idea about the existence of the physical properties of time belongs to N. Kozyrev [18]. By introducing into mechanics an additional parameter taking into account the directivity of the course of time, Kozyrev has formulated the causal (asymmetrical) mechanics, from which it follows that time has physical properties. According to the results of theoretical and experimental investigations conducted by Kozyrev and his followers [18-20,23,24], events can proceed both in time and with the help of time, information being transmitted not only through force fields, but also via a temporal channel. Note that in [23,24] the problem is stated of direct experimental research of the physical properties of time with the purpose to ascertain the relations of a new type between phenomena and discover new methods of changing the state of substance.

With the aim of constructing a rigorous and consistent theory taking into account the possible appearance of the physical properties of time, one should turn to dynamics. As was noted above, it is the dynamical principle that relates the evolution of a system in time to the action of the force fields. As A.A. Logunov underlines, "if for some form of matter we have the laws of its motion in the form of differential equations, then these equations contain information on the structure of space and time" [25]. Obviously, **dynamical equations should contain information** not only about geometrical properties of space-time as a whole, but also **about physical properties of space and time, taken separately** [2,26,27].

According to [26,28], the conclusion that there exist the physical properties of time strictly follows from relativistic mechanics, without introducing any additional hypotheses. The physical properties of time are of purely dynamical nature: their existence is a direct consequence of dynamical principle (principle of causality).

The theory given in [28], which holds only for a point-like particle, can be generalized to arbitrary physical systems, both classical and quantum. One can demonstrate with specific examples

that information on the physical properties of time is contained in dynamical equations, with the help of which the course of time in one inertial reference frame can be uniquely determined from the course of time in the other. The spatially-extended systems – the scalar field described by the Klein-Gorgon equation, the electron-positron field described by Dirac's equation, and electromagnetic field interacting with electric currents and charges - are investigated in detail [29].

Our main results concerning the physical properties of time can be formulated as follows. The course of time in any physical system considered from the point of view of the inertial reference frames moving relative to each other depends on the nature of material processes taking place in the system. The relation connecting the course of time in one inertial frame to the course of time in the other can be derived from relativistic equations of motion for any kind of matter. One can easily derive also the relation connecting the course of time between different points of space, lying on the trajectory of motion of particle and considered in the same inertial reference frame. Note that the case in point is the local time, i.e. the instants relating to the separate points of three-dimensional space.

As is seen from the results obtained, the notion of time as of an entity given from above, which is independent of natural processes, established in the minds of the majority of explorers, is erroneous. Time plays an active role in physical processes. Its flow depends on the state of motion of physical system. The change in the course of time along the trajectory of motion of particle is conditioned by the force acting on particle in a physical field. Apparently, the change in the course of time, in its turn, by virtue of dynamical equations, exerts back influence on the particle's behaviour. The basic difference of relativistic mechanics from Newtonian mechanics consists not only in that time in Newtonian mechanics is of an absolute nature, whereas time in STR flows differently in different inertial frames. **In relativistic mechanics the force is not only the cause of acceleration of particle in an inertial reference frame, but also the cause of change in the course of time along trajectory.** It should be pointed out that the connection between the force and the course of time is due to the existence of the inseparable link between space and time.

Any material system is capable to influence the course of time in that region of space, where it is placed. The ability to change the course of time during the process of motion represents one of the most fundamental properties of physical system, which can be referred to as "the feeling of time". Apparently, "the feeling of time", internally inherent in any form of matter (both particles and fields) by the very nature of things underlies the specific time structure of the material world, whose existence is discussed in [18,23,24].

Thus, the space-time arena, in which physical processes proceed, undergoes continuous changes and deformations as a result of interaction between fields and particles. These deformations, in their turn, can exert some influence on the physical properties of a system. Space and time cease to be passive and become active participants of physical events. The course of time in a certain region of space depends on the character of physical processes occurring in it. The results obtained indicate that the physical properties of time are not preset a priori, they are inevitably created by material systems owing to their movement under the influence of the force fields.

5. Conclusion

The results of the investigations briefly outlined here allow one to gain a more penetrating insight into the true nature of those factors, which operate the world. As electron, the elementary brick of the microworld, is an open self-organizing system, which via the long-range own field is indissolubly related to the whole universe, it is natural to make a conclusion that there works in nature an universal dynamical principle - The Principle of Self-Organization, which can be formulated as

follows: any material object represents an open self-organizing system whose internal structures are formed with the participation of the whole universe. Apparently, the Principle of Self-Organization, incorporated in nature as one of the integral properties of matter, is nothing more nor less than a spirit (or absolute idea, or creator) which operates the world and creates all its variety. It seems to be physically meaningless, however, to tear the property mentioned above away from matter and to ascribe to it a self-dependent existence independent of matter: it exists only to the extent to which the matter does.

As is seen from the results received, any physical process with the participation of charged particles is accompanied by emission in the environmental space of superluminal signals, which transfer information about these processes to the surroundings. Apparently, such an information interchange between material objects provides a possibility of their stable coexistence and is, thus, the most important element of self-organization in the universe.

The ability of electron for self-organization and for information interchange with the surrounding bodies, no matter how far they are spaced, point to the fact that electron is an elementary microsystem possessing the rudiments of reason and all those properties which as a result of the evolution of matter lead to the beginnings of life.

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