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ALTERNATIVE PATHS TO THE DEVELOPMENT OF NATURAL SCIENCES FROM THE PERSPECTIVE OF ENERGODYNAMICS

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ABSTRACT

In this article, several issues of natural science are considered from the perspective of energodynamics, and an attempt is made to outline alternative approaches to explain some accumulated experimental results. For this purpose, it is proposed to first consider the motion forms in their interrelationship, determine the interaction coefficients between them, and, taking into account the multiparameter nature of the system, describe the equations of motion using numerical methods. It is shown that some strange phenomena associated with time can be explained by the interrelation of forms of motion.

INTRODUCTION

Energodynamics is a theory that allows us to proceed to the study of the part through whole and to consider energy systems with any finite number of degrees of freedom, and not only the thermal ones. The important principles, laws and equations of modern sciences are logically derived in the domain of energodynamics by mathematical methods. Numerous experimental studies accumulated testify to the deepening crisis in the natural sciences. The modern trends in development of natural sciences, and particularly in physics, are quite clearly moving in two extreme directions:

- Taking experimental data as a basis, an attempt is made to solve the problem using mathematical logic and methods;
- They are based purely on intuition.

At the heart of every scientific theory are assumptions substantiated by experimental data, in other words, postulates, which are subjective in nature, depending on both the degree of technical sophistication of obtaining experimental data and approaches to evaluating the results obtained. However, often the relevant assumptions made to explain any physical phenomenon are later forgotten that they were only assumptions and continue to be used as absolute truth. From this point of view, an instructive example is Einstein's Special Theory of Relativity. A theory built using an exact mathematical method has

cracks, which is the result of assumptions made on incorrect experimental data, which were formulated as postulates (Ohanian H., 2008, Jormakka J., 2021). It turns out that mathematical logic alone is not enough for the development of physics, the presence of an instinctive feeling towards physics is also very important. Recent discoveries in astronomy show that matter is extremely unevenly distributed in space. There are vast amounts of dark matter and dark energy. This means that new approaches and research are also needed when applying the law of conservation of energy. Finally, a new paradigm is needed, which will first make it possible to get out of the crisis, and at the same time will indicate alternative paths of development. Another important observation: many existing forms of movement are interconnected, but each of these forms of movement is considered independently of other forms of movement. This is justified only by the fact that there are still no interaction coefficients between these forms of movement, and that the forms of movement are still not fully revealed and it is not yet known whether they can be fully revealed or not. There is also a lack of a mathematical conceptual approach, taking into account that we are dealing with a system that cannot be described by simple equations, let alone solved. Therefore, it is necessary to use modern computing technologies for descriptions, by developing algorithms of artificial intelligence programs in specific target problems in order to identify the most significant and valuable forms of movement. The purpose of this work is aimed at discussing these and similar issues and does not at

all claim to completely solve the problem, but is only an attempt to outline the alternative approaches in the development of natural sciences.

Existing ideas about space: Not so long ago, space was considered not only one of the universal main objective forms of the existence of matter, characterized by spatiality and volume, but also as a subjective result associated with consciousness or perception. Theories of the Universe substantiate the properties of space and implicitly assume that the laws of Euclidean geometry are satisfied in physical space. Euclidean space, according to Poincaré (Poincaré H., 1902), is continuous, infinite, three-dimensional, homogeneous, or homogeneous and isotropic. According to Noether's theorem (Noether, E., 1918, *Sardanashvily, G.*, 2016) the homogeneity of space is associated with conservation of momentum, and isotropic nature of space determines conservation of angular momentum. According to the Theory of Relativity, space is not three-dimensional, time is not linear, and neither is it a separate independent factor, but is closely intertwined, forming a single space-time entity. In addition, according to the General Theory of Relativity (Einstein A., 1917), space and time are closely related to the mass of a body. In the strong gravitational field of massive bodies, time can slow down and space can become curved. In this new picture, the apparent distinction between matter and empty space disappears.

Current understandings of time: Time is one of the fundamental concepts of physics and at the same time, still remains one of the greatest mysteries of nature. The main topic of discussion is: is time a way of our perception of this world or something that actually exists? As we know in everyday life, time is a quantitative measure of the variability of objects, and how to compare changes in different objects? The patterns and speeds of development of individual phenomena depend on many factors. To compare the speeds of different phenomena, one standard cyclical process is chosen and the problem is solved according to it. Another question is what to accept as a standard, for example, the orbits of celestial bodies, decay rates of radioactive isotopes, or ability of some crystals to emit "precise" pulses under influence of an electric field. In any case, this standard should be as constant as possible throughout the entire period of observations. Currently, there are two different concepts of time, which differ from each other in interpretation of the relationship between time and matter.

- The realist concept, whose followers are, for example, Aristotle, Leibniz, (Evangelidis B., 2018, Einstein, A., 1952) assumes that matter by its existence determines the existence of space and time. Without matter, they do not exist.
- In the substantialist concept, whose followers are Democritus, Newton, Kant, Hegel, Kozyrev (Shikhobalov L. 1996),the space and time are assumed to be independent phenomena, such as the electromagnetic or gravitational fields, the chemical elements, etc.

The contradictions in these two concepts are so obvious that no compromise is possible. However, it should also be taken into account that there are fundamental unanswered questions on both sides, therefore there is a need for a new concept. To characterize a system means to have not only time and location, but also to have all other parameters (temperature, taste, smell, pressure, etc.) Here we should also add the fields of force, information and desires. In other words, a person and the environment should be viewed as a complete system: there is a force field outside a person, there is also a person who can create a force field and interact with the surrounding field. There is an information field, there is also a person who can use this field and create new information as a result of his activity. A person's desires to create something (and to create by changing the environment) give rise to new desires. That is, the concepts of force, information and desire are also not outside a person, but are in a person-environment mutual dependence. Therefore, it is unnecessary to talk about the exclusivity of any parameter. Space and time, according to Kabbalah, are only feelings. The feeling of time is feeling of changes and their comparison with each other. If everyone feels the same, then it is perceived that everyone has the same feeling. There are many feelings and they are interconnected (according to Kabbalah, there is a feeling of power, information and desire).Like other feelings, the feeling of time can also be more developed in some people, in addition, a person is able to speed up or slow down the course of time (for example, by slowing down his own or someone else's heartbeat). There are many unknowns in understanding of time and new approaches are needed to define it as accurately as possible. On the other hand, physicists have achieved some results in understanding time. This is expressed, for example, in astronomy in determining the positions of planets in space and time. The fact that time is included in the expressions describing the changes in each phenomenon is purely conditional, it is done in order to quantitatively determine the changes in parameters among each other. It has already been said that time is not the only parameter for recording variability, but is it the most convenient and successful? These questions can be answered unequivocally today - yes, and in general, there is still no parameter that would be common in all fields in a convenient way to record changes. Later, we will look at more convenient parameters used in the fields of biology and geology. For now, let us consider astronomical time as an important parameter, and try to understand its essence and the problems associated with it. In modern physics, the law of conservation of energy in a system is associated with the assumption of homogeneity (or uniform change) of time. That is, if physical laws do not depend on when the phenomena occurred, then conservation of energy is obtained and vice versa. On the other hand, only 5% of energy is visible or understandable to humans, which means that the law of conservation of energy is not always to be accepted unconditionally. It should also be admitted that the requirement of the homogeneity of time does not stem from the essence of time, but is a compromise in order not to entangle the equations in physics. From this we can conclude that the same applies to the law of conservation of energy, since it is a consequence of the assumption of the homogeneity of time. More revolutionary approaches to time were presented by Soviet scientists N. Kozyrev (Kozyrev N., 1991, Bischof M., Ludwig T., Kozyrev N., 2020) and A. Veinik (Veinik A., 1968). Here are the main postulates of Nikolai Kozyrev's theory of time:

Time influences all processes and is their necessary component. Everything in nature occurs either with the delivery or absorption of time

Time is a source of energy: Calculations carried out by Kozyrev showed that the activity of stars is due not only to their internal nuclear reactions, since in this case they would be shining only for 4-5 billion years, while their life span is much longer. This means that stars receive additional energy from the surrounding space. If we consider that practically space consists of vacuum, but at the same time is inextricably linked with time, then it is logical to assume that it is time that serves as a kind of raw material for the "feeding" of energy to stars and preventing the thermal death of the universe.

Time is an active substance that maintains the balance of our world. It does not propagate like light, but appears everywhere at once

The direction of time from the past to the future can change: The starlight that we see is already the past, since it has been flying to Earth for many years. But if we point a telescope at the place where, according to mathematical calculations, this star is located at that very moment, then, according to Kozyrev's experiments, nearby physical instruments would record some changes in parameters (in particular, additional voltage). That is, they somehow reflect influence of the future. According to Kozyrev's first postulate, it is argued that the origin of the enormous energy emitted by stars cannot be explained from the point of view of modern physics. For the first time, the idea was expressed to connect the emergence and accumulation of energy in the Universe with the participation of time and to emphasize the need to study the properties of time from this point of view. In his second postulate, Kozyrev admits that time is a source of energy and receives this energy from the vacuum. And what is the vacuum?

According to the author, it is absolute emptiness, which is impossible, since there, different types of fields always exist. If the field is energy, and energy is mass, then ignoring the vacuum and considering time as a source of energy is not justified. Taking this into account, it can be argued that the 1st and 2nd postulates are not successful assumptions. On the other hand, if time is a source of energy, then it is material, this is also fixed in the 3rd postulate, which, as we will see later, creates many absurd situations. Another controversial interpretation is the statement in the 4th postulate that the registration of a planet with a telescope at a mathematically calculated place is related to the influence of future. If the speed of light is considered the limiting speed and information does not spread faster than that, then this should not be possible. Otherwise, it can be concluded that information spreads faster than speed of light. Such a conclusion, which is substantiated by experiment, contradicts the Theory of Relativity, but did not serve as a basis for analyzing the well-known formula $E=mc^2$, which has caused numerous misinterpretations in physics. According to the Vainik paradigm, the Universe consists of matter and the behavior of that matter, while time and space are their characteristics. Thus, the conclusion is as follows: mass is energy. Time is material, which also means that time is also energy. The result is confusion: time, energy, mass, as well as information closely related to these concepts, are material and energy. In this case, it turns out that all these concepts are derived quantities from each other and to describe general phenomena, one should rely on only one of these parameters. It should be noted that this confusion arises from the expression $E=mc^2$, from which not only follows the equivalence of energy and mass, but also gives rise to the hypothesis of considering time as a source and an absorber of energy. Let us recall that when deriving the expression $E=mc^2$, the Theory of Relativity assumed that the speed of light is a limiting speed, which is reflected in the Lorentz transformations. Let us write the expression $E=mc^2$ in another form: $4\pi E \cdot t^2/S=m$, whereby the equation $4\pi E \cdot t/S=m/t$ can be interpreted with the accuracy of a constant factor as the energy released per unit time from a spherical surface S enclosing the mass m. In order for this energy not to decrease, according to Kozyrev, time must generate energy, only in this case the constancy on the right-hand side will be preserved, since there is no other parameter. Many may object that the expression $E=mc^2$ has justified itself in estimating the quantitative values of energy production during nuclear fission and the fusion of nuclei. However, those involved in this field can assure that fission and fusion do not obey this formula: energy is generated and distributed among the resulting particles, but the total mass does not change.

Proper time: Choosing astronomical time, which is associated with the patterns of planetary motion, as a standard of time is not the only and, most importantly, the best option. As mentioned above, there are other options. However, it should be noted that, first of all, these alternative methods do not always accurately represent the size of the standard time and it is not always possible to use standard time to measure time in biological, geological and other systems. As an example, we can cite the rapid development of a biological system in some cases, when it becomes obvious that the rate of aging of the organism is in sharp contrast to the age measured by astronomical time, which qualifies as a disease. As we know, it is customary to consider time as a measure of the variability of systems. As a rule, the variability of any selected object is taken as a standard, while other variabilities are measured with its help. Each system has its own measure of variability and one should be careful when generalizing this criterion for all systems. On the other hand, variability is characterized by the rate of change of parameters, which is directly related to the time of a given system. In other words, when defining time for each system, we will deal with the rates of change of parameters occurring in that system. The "true" age of a system can be measured not on an astronomical, but only on the system's own time scale. But for this, the "own scale" must be substantiated and constructed. In the applied issues of science of aging (gerontology), substantiated markings of biological age of an organism are employed. Otherwise, one can end up with, for example, the twin paradox. The twin paradox, according to Albert Einstein's Theory of Relativity, is as follows: if one of the twin brother flies into space at a speed close to the speed of light, and the other remains on Earth, then when the traveling twin returns to Earth, he will be younger than his brother. The paradox itself is that the Earth was moving relative to the traveling brother, which means that the twin that remained on Earth should be getting younger. Most researchers do not consider the "twin paradox" to be a manifestation of the contradiction of Theory of Relativity and put forward new explanations for the "paradox".

The existing concept of space and time: Modern science characterizes time as an indispensable property of matter, which is inextricably linked with space and expresses the duration and sequence of changes in the states of all material systems and processes in the world. Time itself does not exist, it appears only when material systems are changed and is constantly connected with space. However, if space is three-dimensional, then time is one-dimensional, asymmetric, irreversible and directed from the past to the future. According to popular belief, time is always and everywhere constant, continuous, it cannot be changed with the help of technical means. The development of science has revealed new dependencies of space and time on material processes. The slowing down of the flow of time in material systems is possible both from the speed of movement of the system and from influence of strong gravitational fields. Thus, it is accepted that time and space are some purely specific characteristics of matter and its behavior.

Research of biological systems: The study of living systems using modern highly sensitive devices is of unqualified interest. There is a lot of experimental data that proves the informational connection among living systems. Moreover, this connection exists not only in a passive state, but also automatically regulates certain vital processes (Bischof M., Ludwig T., Kozyrev N., 2020). In other cases, both the possibilities of influencing at a distance on biological systems by a psychic have been recorded, as well as the physical-chemical properties of experimental samples have changed as a result of such influencing (Snijders L., Naguib M., 2017). There are also many experimental data that document the "abilities" of water or other substances to receive and respond to information (Sargsyan R., Karamyan G., 2014, Kholodilova E., Kuznetsova S., 2014, Pitkanän M., 2019, Emoto Masaru, 2006). Living organisms are extremely complex systems, and various physical and chemical processes occurring in them simultaneously create many opportunities to get confused in picturing their complex phenomena—never penetrating into their essence. In order to find the root causes of discovered effects and build theories that describe them, it appears necessary to study first the simplest systems that are inanimate in nature. This will make it possible to rely on the vast scientific experience of the exact sciences when studying them, to use their entire rich arsenal of ideas and results, taking into account that a living organism as a collective system can react qualitatively differently to changes in the physical-chemical parameters that were used during experiments. From this point of view, the problem is whether the results obtained after studying simple natural systems are sufficient to understand the system as a whole, or should the system be further studied as a whole? This is a question that can only be answered by experiments.

About information: It is generally accepted that time is the duration and sequence of events, and information is the content of events. From this point of view, information contains time and all other parameters. Therefore, only information can act as a quantity describing the state: A (E_1, E_2,....E_n), where E_1, E_2,....E_n are independent forms of motion with parameters describing their mutual dependencies. Information spreads at a finite speed to all points in space and has the property of accumulating at these points. The volume of memory increases, and the updating of information is fixed according to chronology. To record (read) information means to record the change in information depending on some parameter. The accumulation of information at points in space can create the illusion of its spreading at an infinitely high speed. Each piece of information according to specific purpose, has its own value, weight, and trace, which are preserved. Along with the preservation of information, it also undergoes evolutionary development according to other chronology. Since information is always obtained from the past, the

Table 1

The Forms of Macro Motion & the Work Done by Them					
Form of the Motion	Charge x_i	Name	Potential ψ_i	Name	The Work
Displacement	$x_1 = dx$	displacement	$\Psi_1 = F_x$	acting force	$dQ_x = F_x \cdot dx$
Kinetic displacement	$x_2 = dP$	momentum	$\Psi_2 = v$	velocity	$dQ_k = v \cdot dP$
1. Gravitational	$x_3 = dh$	displacement	$\Psi_3 = G$	acting force	$dQ_g = G \cdot dh$
2. Thermal	$x_4 = d\theta$	thermal charge	$\Psi_4 = T$	temperature	$dQ_T = T \cdot d\theta$
3. Electrical	$x_5 = dq$	electrical charge	$\Psi_5 = \varphi$	electric potential	$dQ_q = \varphi \cdot dq$
4. Magnetic	$x_6 = dE_{mg}$	magnetic charge	$\Psi_6 = P_{mg}$	magnetic potential	$dQ_{mg} = P_{mg} \cdot dE_{mg}$
5. Chemical	$X_7 = dm$	chemical charge	$\Psi_7 = \mu$	chemical potential	$dQ_m = \mu \cdot dm$

problems that need to be solved always concern prognosis. The future contains the past. If the state function is information, then the past can always be restored, and the future in this case can only be restored from the restored past. The scope of restoring the future from the past is possible only to the extent that information is accumulated, and for restoration not only complete information is needed, but also intelligence (even artificial) that can receive and analyze this information. Here it is taken into account that not all information is accessible to our senses. It is not excluded that some subjects have overdeveloped senses and even the presence of additional senses, which will allow them to perceive events earlier than ordinary mortals. It is obvious that this will be accepted as a prediction of the future, in some cases also clairvoyance. Clairvoyance, which is expressed in the ability to receive information about past, present and future events, is associated only with the clairvoyant's personality, and not with the methods he uses. There is an opinion that there is a global information bank of information, where information about the future is also accumulated, which the clairvoyant uses. And lastly another interesting observation: if information can be transmitted and received at a speed close to instantaneous, then taking into account the latest achievements in the application of artificial intelligence, it is possible to transmit and also receive technologies in the form of information to other planetary civilizations, if any. This is a way to make the origin of life on planets possible through other terrestrial intelligence.

Systematic approach to the study of the material world: As mentioned in the previous sections, the Theory of Relativity should be treated with strict reservations; moreover, at present it is only an obstacle to the development of science in important matters. This is particularly the case with one of the most famous and fundamental discoveries in physics, Einstein's formula E = mc², which states the equivalence of mass and energy. Other laws that are not traditionally discussed are the laws of conservation closely related to space and time, for energy, momentum, angular momentum, etc., which operate when space and time satisfy certain conditions. The proposed new approaches to describing the system must first of all not contradict the laws that have already been practically justified in time. However, supplementing these laws is always worthy of encouragement.

The following main forms of motion are distinguished:

- Mechanical (spatial movements)
- Physical (thermal motion, etc.)
- Chemical (formation and decomposition of molecules)
- Biological (organic life in all its manifestations)
- Social (development of human society)

When studying the exchange of energy between forms of motion in a system of multiple forms of motion mentioned by Veinik, we will use only the following forms of macromotion, remembering also that there are also unstudied forms of motion (Veinik A., 1968):

There are also many other discovered macro motion forms: informational, vibrational, chronological, filtrational, etc., but for now we will limit ourselves to the ones given in the table, x_i, ψ_i is the charge and potential of the i-th motion form, and dQ_i is the work done by the i-th motion form.

For the total work done by the motion forms, we will have:

$$dQ = \sum_{i=1}^{m} \psi_i \cdot dx_i \tag{1}$$

From (1) we can obtain the following:

$$dQ/dt = \sum_{i=1}^{m} \psi_i \cdot dx_i/dt \tag{2}$$

As can be seen from the form of equation (2), this is the functional dependence of the rate of change of total energy of the system on known motion forms.

Formulation of equations of motion according to the extremum principle: For each elementary form of motion of matter, there is a certain parameter (generalized charge) E, which qualitatively and quantitatively characterizes this form of motion. It is characteristic of a generalized charge to spontaneously propagate in the direction of decreasing potential P associated with it, and its propagation in this direction is accompanied by the release of charge through thermal dissipation of energy, and in the opposite direction by the absorption of charge (Veinik A., 1968). If the matter of the system is characterized by n modes of motion, then for internal energy of the system we can write:

$$U = f\left(E_1, E_2, \dots E_n\right) \tag{3}$$

The differential equation of the energy state of the system will be expressed in the following form:

$$dU = \psi_1 dE_1 + \psi_2 dE_2 + \cdots + \psi_n dE_n \tag{4}$$

where:

$$\psi_1 = \frac{\partial U}{\partial E_1}, \psi_2 = \frac{\partial U}{\partial E_2}, \dots \psi_n = \frac{\partial U}{\partial E_n} \tag{5}$$

Each generalized potential ψ_i is separately associated with the corresponding charge. If $dQ_i = \psi_i \cdot dE_i$ the work is done by the environment, then the work is considered positive and accordingly, enters the differential equation of the energy state with a positive sign. The laws of variability (equations of motion) can be formulated not only as equations, but also as an extremum principle. Formulations of the law of variability in the form of equations of motion and the extremum principles are equivalent. When determining the time changes of the parameters used in extremum principle, standard time is used. If the functional relationships between motions in the system under study are known, then dynamic equations (for example, in mechanics or electrodynamics) can be obtained from corresponding Hamiltonian extremum principle. In mechanics, the principle of least action is a special case of the Hamiltonian extremum principle. By the natural course of system development, we mean the self-management of system when there is no external intervention by man. In this case, man is observed outside the system, which is done purely for private research. Management is a certain purposeful form of interaction, through which the managing subject interacts with the managed object in a predictable way through specific management parameters. As the experience accumulated by mankind shows, both natural course of system development and the purposeful management of system are carried out according to certain regularities. Regularities in the case of the

natural course of system development are found in natural science, social science and other fields. The process of system development is described by a set of specific characteristic parameters, and their changes over time are represented by the equations of motion. The task in this case is to reveal the process in order to predict the future, and if there are appropriate levers, also to manage the development in desired direction. By desirable path, we should understand the optimal way to achieve defined end goal.

The commonality in various forms of movement is that each of them occurs by the conversion of energy in one form or another. The conversion of energy from one form to another essentially already represents movement. As mentioned, one of the laws of motion can be considered that the energy expenditure is extremum. Using this law in particular, one can obtain the equations of motion in classical mechanics or quantum mechanics, etc. We accept this extremum condition as a postulate. Our goal is to formulate the equations of motion in such a way that it reflects the interrelationships among individual forms of motion and also reveals the contribution of each of these forms of motion to the natural and controlled development of system in natural and managed cases. Let us assume that the motion is described by a complete set of charges $x_1, x_2, \ldots x_m$. These quantities themselves change over time, and we denote these changes by $f_1, f_2, \ldots f_m$:

$$\frac{dx_i}{dt} = f_i(x_1, x_2, \ldots \ldots x_m) \; _{i=0,1,\ldots m} \tag{6}$$

where i = 0 corresponds to the energy of the system. According to the postulate, the following condition corresponds to physical process:

$$x_0 = \int_{t0}^{t1} f_0(t)dt \to \text{extremum} \tag{7}$$

where $f_0 = dE/dt$, E is the energy of the system, t is the time.

Assuming that all forces acting on the system are potential and $f_0 = f_0(x, \dot{x}, t)$ where

$\boldsymbol{x} = (x_1, x_2, \ldots x_m)$, condition (7) for generalized potentials and charges can be written in the following form (Pitkanän M., 2019):

$$\frac{dx_i}{dt} = -\frac{\partial H}{\partial \psi_i} \; i = 0,1,2,\ldots \ldots m \tag{8}$$

$$\frac{d\psi_i}{dt} = -\frac{\partial H}{\partial x_i} \; i = 0,1,2,\ldots \ldots m \tag{9}$$

$$H = f_0 + \sum_{i=1}^{m} \psi_i \cdot f_i(x, \dot{x}, t) \tag{10}$$

where: H is the Hamiltonian of the system, m is the number of degrees of freedom of the system. Thus, the extremum condition (7) was presented in the form of canonical equations of motion (8, 9). Hence, the extremum condition (7) is now represented in the form of equations (8,9), which are the equations of motion. Thus, in the case of natural course of system's development, the generalized potentials and charges are chosen based on the condition sup $H(\text{x}, \psi) = 0$.

To describe the course of the development of controlled system, it is first necessary to define the effective control parameters for a specific target case, and then determine the values of these parameters in such a way that the extremum condition is satisfied. When objectively the functional (7) is chosen, the state of the system is considered as an evolutionary process. The problem mentioned in the interpretation of variational calculus is solved on the basis of Pontryagin's maximum principle (Pontryagin L., Boltyanskii V., Gamkrelidze R., Mishechenko E., 1962). To describe the state of the controlled system, according to criterion (7), the initial **V** parameters are separated in the Hamiltonian, through which the state of the system is controlled. Then the Hamiltonian of the system is written in the form (10); depending on whether the maximum or minimum problem is being solved, $\psi_0 = +1$ or $\psi_0 = -1$, and **V** is the vector of controlling parameters. Pontryagin's maximum principle is applied to determine the values **V*** corresponding to the development processes of such system. This results in solving the system of equations (8,9)

corresponding to the generalized charges and potentials, with control parameters varying in the range $V_{min} \leq V \leq V_{max}$. The search for **V*** values in a given interval is carried out from the limiting values of functions V^{lm} and V^{cl} (Pontryagin L., Boltyanskii V., Gamkrelidze R., Mishechenko E., 1962), determined by the following condition:

$$\frac{\partial H}{\partial V_k^{cl}} = 0, k = 1.2 \ldots q$$

The development of system with determined parameters **V*** will satisfy the following condition:

$$H^*(X, V) = \sup_V H(X, V) = 0 \tag{11}$$

Hamiltonian mathematical apparatus as given by equation (11) is convenient to describe the interrelations among the motion forms. Later, the valuations of motion forms in the system under specific functional dependencies will be shown.

New paradigm: As the history of development of science shows, each paradigm is not a fixed phenomenon. Initially being progressive, as a result of the accumulation of new experimental data it can become a factor inhibiting the development of science. This means that one must constantly look for ways to make refined experimental results more descriptive, using intuition among other things.

As a paradigm the following provisions are proposed:

- Recognition of the world is limited within the framework of accumulated information, while information undergoes an evolutionary process and is unlimited
- The Universe consists of substances that are characterized by the behaviors they exhibit
- Substance is primary, its behavior is secondary
- Cause-and-effect relationships are operating
- Every natural and purposeful guided movement occurs under the extremum condition of a specific purposeful process.

Particular examples of applications: Now, using equation (2) describing the change in "total" energy of the system and Pontryagin's maximum principle, let us try to obtain the known equations of motion or their alternatives for particular cases. According to the notations given in Table 1, equation (2) in this case will be represented as:

$$H = \sum_1^m \psi_k \frac{dx_k}{dt} \tag{12}$$

Newton's equation of motion

In the case when a material particle with mass m performs a kinetic displacement in a potential field U, equation (12) can be written as:

$$dH = vdP + dU$$

where: $\frac{dx_1}{dt} = v, \psi_1 = P, \frac{dx_2}{dt} = -1, \psi_2 = U, x_1 = x, x_2 = -t$

The energy of system is given by

$$H = vP + U$$

whereby, $\frac{d\psi_1}{dt} = -\frac{\partial H}{\partial x_1}$ or $\frac{d\psi_1}{dt} = -\frac{\partial U}{\partial x_1}$ and $\frac{d\psi_2}{dt} = 0$

assuming that $U \neq U(t)$. As a result, we obtain:

$$\frac{\partial P}{\partial t} = -\frac{\partial U}{\partial x_1} \tag{13}$$

which is Newton's equation of motion.

The alternative of Maxwell's equations in an electromagnetic field
Now consider a stationary system located in the external electric **E** and magnetic H fields. The energy per unit volume U_v of such a

system is a function of D and magnetic induction *B* vectors, which in turn depend on the *E* and *H* field magnitudes, and has the following form:

$$dU_v = E \cdot dD + H \cdot dB \tag{14}$$

The members on the right side of this expression respectively characterize the basic works of polarization of given body, $dW_{ev} = E \cdot dD$ and of magnetization, $dW_{mv} = H \cdot dB$

Let us assume that in such a system, processes of mutual conversion of the energy of electric and magnetic fields are carried out, the powers of which are:

$$N_e = E \cdot \frac{dD}{dt}; N_m = H \cdot \frac{dB}{dt} \tag{15}$$

If during such processes the power balance is maintained as $N_e = -N_m$, then

$$E \cdot \left(\frac{dD}{dt}\right) = -H \cdot \left(\frac{dB}{dt}\right) \tag{16}$$

From this expression we can obtain Maxwell's equations (Etkin V., 2011, 2010, 2008) as:

$$rotE = -\frac{\partial B}{\partial t} \tag{17}$$

$$rotH = j_e + \frac{\partial D}{\partial t} \tag{18}$$

$$divD = \rho_e \tag{19}$$

$$divB = 0 \tag{20}$$

First of all, let us note that equation (14) is a particular form of proposed approach, which, in addition to the mentioned approximations, excluded interactions with other forms of motion; and the assumption of power balance, $N_e = -N_m$, is already a serious unfounded approximation. If we follow the proposed approach, then the alternative to Maxwell's equations in the electromagnetic field should be written taking into account interactions of general forms of motion. This in the case of the same approximations as in equation (12), in particular will turn into equation (14), after which it will already be the well-known system of Maxwell's equations. These examples can be continued, but they are only particular examples. It is more important to consider the complete set of known forms of motion, taking into account their interrelations. This problem already requires new approaches, since the analytical approach is a dead end. As we see, in particular cases the well-known formulas are obtained, from which it follows that expression (12) has a general nature and can become "universal" if all forms of motion are included. Here, the term universal is taken in quotation marks because it refers only to the known forms of motion.

Assessment of the influence of bio-objects on the behavior of systems: As mentioned, bio-objects, especially humans have an important influence on systems. How to quantitatively assess the size of this influence? According to expression (12), this can be done if we include the forms of movement of the human-system interaction in the equations. Such forms of movement are purposeful movements, and in order to achieve the goal of movement, a person uses the power, information and desire energies available to him. Here, an important circumstance is the introduction of idea of conditional extremity, so that in principle, as a condition, a person's own mental abilities are also taken into account, which, under other equal conditions, can give diametrically different results when solving the same specific goal-oriented problem. The forms of movement of human-system interaction may seem insignificant only at first glance, but if we clarify the system and the dependence of its goal-oriented functional on human behavior, it will become clear that human-system interaction can be fatal for both the person and the system itself. This is an interesting area of research, but the essential forms of

movement in this direction have not yet been clarified and additional experimental data are needed.

Revealing the dependence of proper time on the forms of movements: The duration of a process in a system can be measured not on an astronomical scale but only on the system's own time scale. But for this, the "own time scale" must be justified and constructed.
By the proper time of a system we mean the relationship between a parameter characterizing a quantity in that system and the rate of change of that parameter. The change in the parameter in time interval *dt* is measured according to standard time. Such an approach will allow us to determine the proper time in a system depending on other forms of motion, which will make it possible to reveal the acceleration or deceleration of processes of various phenomena, not only depending on the speed of movement of system but also on various forms of motion outside the system. It is an important and a separate issue to take into account the human-environment interdependence when determining the proper time of system. According to Einstein's General Theory of Relativity, where gravity is stronger, the time slows down. The closer to center of Earth, the force of gravity is stronger, therefore time should flow more slowly in the area near the Earth.

Now let us recall our ideas about proper time again and determine the change in time in the system with a specifically chosen parameter, depending on forms of motion acting in system. Let us consider the case when the forms of macromotion highlighted in Table 1, operate in system and also there is a fissile radioactive isotope.

The total energy of fission of an amount *dN* of the isotope will be $E_r \cdot dN$, where E_r is the energy released during an act of fission, and for the total energy of the system we have (Veinik,1968):

$$dQ = F_x \cdot dx + v \cdot dP + G \cdot dh + T \cdot d\theta + \varphi \cdot dq + P_{mg} \cdot dE_{mg} + \mu \cdot dm + E_r \cdot dN \tag{21}$$

If we define time as *t=N/(dN/dt),* then we obtain:

$$t = \frac{N \cdot E_r}{\left(\frac{dQ}{dt} - F_x \cdot \frac{dx}{dt} - v \cdot \frac{dP}{dt} - G \cdot \frac{dh}{dt} - T \cdot \frac{d\theta}{dt} - \varphi \cdot \frac{dq}{dt} - P_{mg} \cdot \frac{dE_{mg}}{dt} - \mu \cdot \frac{dm}{dt} - E_r \cdot \frac{dN}{dt}\right)} \tag{22}$$

As can be seen from the expression obtained, it turns out that there are many stimuli for acceleration or deceleration of time, which in different cases can have a greater or lesser effect. In particular, the proper time in the system can slow down compared to the reference time, or it can speed up depending on the force of gravity or the rate of its change. It also turns out that, without resorting to the theory of relativity, only changes in internal laws of system motion can explain both the well-known "paradox" of twins and the slowing down of time in a strong gravitational field without hypothesis of curvature of space. Accordingly, these changes are result of interaction of motion patterns and are not associated with the physical properties of time.

"Violation" of the law of energy conservation as a consequence of incomplete studies of motion forms and dark energies: It becomes clear from the presentation that application of the energy conservation law should not be approached unconditionally. The diversity of motion forms and their incomplete study are a serious obstacle to absoluteness of energy conservation law. On the other hand, the problems associated with dark matter and dark energy are still under investigation. As noted, according to some publications (Freeman, K. and McNamara, G., 2006, Stapelberg, S., 2022), known types of energy make up only 5% of undiscovered energies. Not taking this into account means accumulating numerous errors in discovery of new particles or in other epistemological problems.

Valuation of motion forms in the specific problems under discussion: The valuation of motion forms becomes meaningful when the form's objective functional is known, following which it is already possible to reveal the value of each motion form in the behavior of that functional. The application of the proposed extremum principle for specific cases allows us to value each motion

form in the objective functional, according to which to some extent orientationin research process is provided. Each movement has an evolutionary development and it is not correct to determine the contributions of movement forms to energy balance just by the initial parameters describing such movement. It is necessary to find quantities in formulation of the problem that are a necessary condition for development and only under this condition to evaluate the movement forms. In the case when it is important to reveal the natural course of actions caused by energy changes in the process, we will use expression (2) as energy balance in energy dynamics and accept as a necessary condition in the case of the Hamiltonian extremum. And when it is necessary to manage the process, assessment of contributions of movement forms for the specific problem under consideration can be made, based on requirement of extremum of corresponding target process. In this case, if we consider the target functional of process as $F[f_1(t), f_2(t), \dots f_m(t)]$ then (Pontryagin L., Boltyanskii V., Gamkrelidze R., Mishechenko E., 1962): $H = f_0 + \sum_{i=1}^{m} \psi_i \cdot f_i(x, \dot{x}, t)$

Where

$$\psi_i(t) = \frac{\partial F[f_1(t), f_2(t), \dots f_m(t)]}{\partial f_i(t)} \Big/_{f_0 = f_i(t_0)} \quad i = 1, 2, \dots m \qquad (23)$$

$$\text{and } f_0(t) = \frac{dF[f_1(t), f_2(t), \dots f_m(t)]}{dt} \qquad (24)$$

Equation (24) is the definition of the value of the charge of the *i*-th motion in the objective functional, as the response of the functional to a small change in the velocity of that charge, from the initial moment $t_0$tothe t instant of the functional. It is also important to clarify the contribution of each motion form to the objective functional. As follows from the Hamiltonian form, the following can be accepted as such a contribution of motion forms:

$$B_i(t) = \psi_i(t) \times f_i(t) \quad i = 1, 2, \dots, m \qquad (25)$$

Solving problems with such a setting is impossible without the use of numerical methods. On the other hand, it seems quite logical to involve artificial intelligence in solving specific objective problems, considering that mathematical toolset for solving such problems is quite well developed.

For example, the following algorithm can be proposed:

- Formulate the forms of motion in energy system
- Obtain corresponding equations of motion based on the Hamiltonian extremum condition
- Determine the motions that have a large contribution to the system
- Determine the effective control parameters based on classification of the motions that have a large contribution to the system.

Such an approach, which has previously been used to study kinetic models of chemically interacting systems (Tavadyan L., Martoyan G., 1994, 2014, Martoyan G., Tavadyan L., (1992, 2001, 2003), will create great opportunities in the areas of development of theoretical and experimental sciences, in each case making the most of available scientific information.

CONCLUSIONS

Cognition has no boundaries. As can be seen from this essay, the forms of movement are very diverse, and in addition, interrelations between them greatly complicate the process of cognition. Definition of proper time and the discovery of its dependence on the forms of motion prove that it is not time that generates energy, as Kozyrev claims, but simply that energy manifests itself as a result of the collective interactions of various forms participating in the movement. In addition, it is shown that acceleration or deceleration of the course of time depending on gravity can be explained by the fact of interactions of interconnected forms of movement in the system,

without resorting to the hypothesis of curvature of space proposed by the theory of relativity. The course of proper time can be changed not only by changing the effect of gravity, but also by involving other forms of movement and revealing and using the role of their effects in the process. Taking into account these facts, it can be stated that time is not material, and the twin paradox as such does not exist. Considering the diversity of movement forms, the hopelessness of analytical approach in revealing systemic patterns of development becomes obvious; instead, a new field and mechanism of research using numerical methods is proposed. An important contribution to this mechanism is an approach to evaluating each form of movement in the energy system, which allows us to assess the contribution of each form of movement to the process in the studied system.

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