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To the theory of absoluteity

Abstract

A method for studying isolated systems is proposed, based on the introduction of specific parameters of the spatial heterogeneity of such systems. The method makes it possible to consider the deviation of a system from equilibrium both as a whole and for each inherent degree of freedom, without requiring the use of inertial reference systems and any postulates of SRT and GTR. On this basis, an alternative TR theory has been proposed, which allows one to find the absolute reference system (AFR) for any of the processes occurring in it. The application of this theory to mechanics reveals the inconsistency of the postulates of SRT and GTR and sets up the minimum number of adjustments that need to be introduced into mechanics and the theory of gravity in connection with recent discoveries in astrophysics. A modified form of Newton's law has been found, which explains gravity by the inhomogeneous distribution of mass in space and predicts the existence of gravitational repulsive forces and "strong" gravity. Observational and experimental data are presented that confirm the main provisions of the proposed theory.

Keywords: methodological principles, conservation laws, postulates of relativity, their inconsistency, the nature of gravity, alternative to relativity

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Introduction

One hundred years have passed since the emergence of the theory of relativity (RT). Nevertheless, the discussion continues about the validity of the postulates underlying it and their consequences. Attempts to answer these questions from the standpoint of any theory that explains only one area of physical phenomena most often conflict with the consequences of another. This is what happened when building the foundation of modern physics based on the theory of relativity (TR) and quantum mechanics (QM), the inconsistency of which with each other became the cause of its deep crisis. The search for a compromise between QM and TE will apparently continue indefinitely if the "scientific community" does not realize that not only mechanics, but also electrodynamics should become equal sections of a single physical doctrine that considers quantum mechanics and the theory of relativity as special cases of mechanics discrete processes and relativistic speeds. To do this, it is necessary to change the research methodology itself with a transition to a deductive method and a systematic approach, requiring the study of the subject of research "from the general to the specific" and "from the whole to the part."

The closest to these requirements today is energy dynamics, which is the result of a consistent generalization of the classical thermodynamics of polyvariant systems[1] to inhomogeneous media[2] and non-static (irreversible) processes of transfer and transformation of any forms of energy in them[3] with the subsequent application of this theories to thermal and non-thermal, mechanical and non-mechanical, technical and non-technical phenomena in the world around us.[4] This theory extends the deductive thermodynamic method of research, based on the properties of the characteristic functions of the object of study as a whole,[5] to isolated heterogeneous polyvariant systems, including the complete set of interacting (mutually moving) material objects. At the same time, unlike "pseudo-thermostatics" by W. Thomson (Kelvin)[6] or "quasi-thermodynamics" by L.Onsager,[7] it does not exclude from consideration any (irreversible or reversible) part of real processes. Such a general approach, along with the classical ideas of space as the container of "everything that exists," makes it unnecessary to involve any postulates of SRT and GTR and allows us to compare their conclusions with classical thermodynamics, the consequences of which are in the nature of immutable truths.

Methodological features of energy dynamics

Energy dynamics as a unified theory of real processes of transfer and transformation of any form of energy does not recognize the priority of hypothetical inertial frames of reference (IRS), since "we have no way to be sure whether we are participating in such movement or not".[8] Based on the same argument, energy dynamics, as opposed to TR, puts forward the "principle of absoluteness": physical laws must be written in FR, which still is unchanged during the processes under study and allows these laws to be presented in the simplest and most understandable form. Energy dynamics considers the center of the volume occupied by an isolated system as such an "absolute" reference system (AFR). This is, in the general case, the center of the Universe, which includes "everything that exists," or any material object in it, the position and state of which stays unchanged with acceptable accuracy during the course of the process under study. By this, energy dynamics considers as an object of study such a set of interacting (mutually moving) material objects that would be generally motionless and therefore would not require inertial reference systems (which, strictly speaking, do not exist). Another feature of energy dynamics is the explicit consideration of the irreversibility of any real processes. It is known that in nonequilibrium systems, any of their parameters can change both because of external energy exchange and because of internal spontaneous processes. This circumstance gives rise to the well-known problem of thermodynamic inequalities, which consists in the fact that in such systems external heat transfer and work cannot be expressed through the parameters of the system. In principle, there are two ways to overcome this difficulty. The first is associated with limiting the range of objects under study to equilibrium systems, all processes in which are decided exclusively by external energy exchange. These are classical mechanics,[9] thermodynamics,[10] electrodynamics,[11] etc. A similar approach is used by continuum mechanics,[12] locally equilibrium thermodynamics of irreversible processes,[13] and the theory of heat and mass transfer[14] etc. These theories are explicitly or implicitly based on the hypothesis of local equilibrium,[15] which assumes that the elements of the volume of the continuum are in equilibrium (despite the occurrence of irreversible processes in them), and their state is characterized by the same set of variables as in homogeneous systems (despite the presence of gradients of intensive quantities), so that for them all thermodynamic relations in the form of equalities remain valid (despite their inevitable transition into inequalities). Meanwhile, the fragmentation of a system into an infinite number of elementary volumes leads to the loss of "system-forming connections," thanks to which the system buys properties that were absent in each of its parts (subsystems). The discovery of this was the cause of "the greatest and most profound shock that physics has experienced since the time of Newton".[8]

Energy dynamics offers a diametrically opposite path.[4] It consists of considering as an object of study such a set of subsystems, all processes in which can be considered internal with acceptable accuracy, as well as their energy U. This means that if doubt arises about the possibility of neglecting external forces, for example gravity, then their sources must also be included in the system under study. For such systems, their entire mass M is the "rest mass M_o," and the rest energy E_o is identical to the internal energy U, which does not depend on the position or motion of the system relative to the "environment." That is why all arguments of the internal energy U are measured in thermodynamics on absolute scales that do not depend on the state of the reference frame (FR). These are the absolute temperature T, the absolute pressure p, as well as the entropy S, which, by the 3rd law, also vanishes at T = 0. Otherwise, obviously, the internal energy U as their characteristic function would change with a change in state or movement of TR even in the absence of energy exchange with the external environment, which would entail a violation of the law of its conservation. Therefore, energy dynamics, like classical thermodynamics, is a "theory of absoluteness" despite tries at relativistic transformation of its parameters leading to paralogism.[16]

Energodynamics is based on principles that are not inferior in generality to the principles of the excluded perpetual motion machine of the 1st and 2nd kind. The main one is the "principle of distinguishability of processes", which, in accordance with centuries of experience, asserts the possibility of identifying (using the entire arsenal of experimental means) independent processes not only by the reasons that cause them and the conditions of their occurrence, but also by those special, phenomenologically distinguishable and irreducible to other changes in the state of the system that they cause. Based on this principle, which is axiomatic in nature, a theorem is proved (by contradiction) according to which the number of independent arguments of the energy U of any system is equal to the number of independent processes occurring in it. For equilibrium systems, such arguments were the mass M, the number of moles of k-x substances N_k, their entropy S_k, charge 3_k and other extensive parameters Θ_i, which serve as a quantitative measure of the carrier of the i-th form of energy U_i. At the same time, from the principle of distinguishability it follows that in inhomogeneous isolated systems internal processes of redistribution of parameters Θ_i over the volume of the system V necessarily arise. Indeed, representing any parameter Θ_i through its local ρ_i and average $\overline{\rho}_i$ density $\Theta_i = \int \rho_i dV = \int \overline{\rho}_i dV$, we find that for such systems

$$\int(\rho_i -)dV = 0\,. \qquad (1)$$

This means that in different areas of such systems the density difference ($\rho_i - \overline{\rho}_i$) has a different sign, i.e. the processes $d(\rho_i - \overline{\rho}_i)/dt$ have the opposite direction. To describe them, it is necessary to introduce, in the general case, the same number n of added parameters of "spatial heterogeneity". Such parameters $\mathbf{Z}_i$, which we called their "moments of distribution," are found by the displacement of the position of the radius vector $\mathbf{R}_i$ of the center of extensive quantities Θ_i relative to their first position $\mathbf{R}_{io}$ in a homogeneous system:

$$\mathbf{Z}_i = \Theta_i(\mathbf{R}_i - \mathbf{R}_{io}) = \int(\rho_i - \overline{\rho}_i)\mathbf{r}dV, \qquad (2)$$

Where **r** is the running (Eulerian) coordinate. In this case, the position of $\mathbf{R}_{io}$ coincides with the center of the fixed volume V occupied by the system and therefore is taken as the zero of the $\mathbf{R}_i$ reference.

Thanks to the introduction of "distribution moments" $\mathbf{Z}_i = \Theta_i\mathbf{R}_i$ with a shoulder $\mathbf{R}_i$, the classical method of thermodynamic study of processes based on system parameters extends to inhomogeneous systems. In this case, the total differential of the internal energy of the system as the sum of the "partial" energies of all its i-th forms $U_i(\Theta_i, \mathbf{R}_i)$ can be represented in the form of an identity[4]:

$$dU \equiv \Sigma_i\Psi_i d\Theta_i - \Sigma_i \mathbf{F}_i \cdot d\mathbf{R}_i, \qquad (3)$$

where $\Psi_i \equiv (\partial U/\partial\Theta_i)$ is the volume-averaged value of the generalized potential of the system ψ_i (absolute temperature T and pressure p, gravitational potential ψg, chemical μ_k and electrical φk potential of k-th substances, components υ_k of the relative speed of their movement υk and etc.); $F_i \equiv -(\partial U/\partial R_i)$ – forces in their general physical understanding; i = 1,2,…, n – the number of independent forms of energy of all components of the system.

In homogeneous systems (where $\mathbf{R}_i = 0$), identity (3) goes into the generalized equation of the 1st and 2nd principles of equilibrium thermodynamics of polyvariant systems as the law of conservation of their energy when exchanging it with the environment; in closed conservative systems ($d\Theta_i = 0$) – into the law of conservation of energy when transforming the i-th forms of energy $U_i(\Theta_i, R_i)$ into the j-th $U_j(\Theta_j, \mathbf{R}_j)$. This is how thermodynamics is synthesized with other disciplines that operate with the concept of force $\mathbf{F}_i$, including the thermodynamics of irreversible processes,[17] due to which the flows Ji and thermodynamic forces $\mathbf{X}_i$ in it acquire a simple and clear meaning, respectively, of the momentum of the energy carrier Θ_i:

$$\mathbf{J}_i \equiv d\mathbf{Z}_i/dt = \Theta_i d\mathbf{R}_i/dt = \Theta_i\mathbf{v}_i \qquad (4)$$

and the strength of the corresponding field (temperature, pressure, chemical, electrical, gravitational, etc.)

$$\mathbf{X}_i \equiv -(\partial U/\partial \mathbf{Z}_i) = -\Theta_i^{-1}(\partial U/\partial \mathbf{R}_i) = \mathbf{F}_i/\Theta_i\,. \qquad (5)$$

In this case, the forces $\mathbf{X}_i$ and $\mathbf{F}_i$ are directed towards setting up a homogeneous (internally equilibrium) state of the system. In isolated systems, identity (3) becomes zero, and all forces $\mathbf{F}_i$ and $\mathbf{X}_i$ become internal, and the processes generated by them become spontaneous. This allows energy dynamics to solve a wide range of issues related to real (irreversible) processes, even before using the uniqueness conditions it draws from specialized disciplines in the form of the equations of state $\psi_i = \psi_i(\Theta_i)$ and transport $J_i = J_i(\Theta_i, \mathbf{X}_i)$.[18]

Generalization and unification of the concept of force

All processes in isolated systems are caused by the interaction of carriers of various forms of energy in various parts of the system, i.e., their influence on each other. The quantitative measure of the influence of one body on another in classical mechanics was the force of the i-th nature $\mathbf{F}_i$, and the result of this influence was measured by the work W_i, the elementary amount of which was measured by the product of this force $\mathbf{F}_i$ by the displacement $d\mathbf{R}_i$ of the object of its application caused by it. According to (3) this works,

$$\delta W_i = \mathbf{F}_i \cdot d\mathbf{R}_i = \mathbf{X}_i \cdot d\mathbf{Z}_i\,. \qquad (6)$$

According to Newton's 3rd law, action always equals reaction. However, from the standpoint of energy dynamics, the result of this action depends on the nature of the force opposing it. If the opposing force is of the same nature ($\mathbf{F}_i = -\mathbf{F}_i$), that is, the active force is balanced by a reaction force of the same kind, the system stays in equilibrium. However, if the force $\mathbf{F}_i$ is opposed by a force of a different, j-th nature ($\mathbf{F}_i = -\mathbf{F}_j$), the transformation of the i-th form of energy U_i into the j-th U_j occurs. Thus, energy dynamics distinguishes the processes of energy transfer (exchange of energy in the same form), described by the first sum (3), from the processes of energy transformation associated with the transfer of energy to another energy carrier and described by the second sum (3). The first case is considered in the thermodynamics of open systems in connection with mass transfer (Θ_i = M) and diffusion ($\Theta_i = N_k$), where it is called the "input work" $\delta W_i^{BB} = \Psi_i d\Theta_i$. Energy dynamics generalizes this type of work to the case of introducing electric charge ($\Theta_i = 3$) and entropy (Θ_i = S), calling them disordered due to the absence of the resulting $\mathbf{F}_i$. Work (4), described by the second sum (3), has a different character. It is distinguished by the presence of the resulting Fi and is associated with the movement $d\mathbf{R}_i$ of the energy carrier Θ_i in its redistribution throughout the system. As a result of such work, the partial energy U_i of the isolated system changes, which under the conditions $U = \Sigma_i U_i$ =const means the transformation of the i-th form of energy into others. Therefore, work of this kind is a quantitative measure of the energy conversion process. Due to the directional nature of the movement $d\mathbf{R}_i$ of the energy carrier Θ_i, it is called ordered work in energy dynamics. It is this category of work that is considered in mechanics and other disciplines that run with the concept of force.

The theory of relativity (TR) and quantum mechanics (QM), having abolished the concept of force and replaced work with exchange interaction, attributed the cause of the occurrence of a particular process to the curvature of space and the exchange of "virtual" particles between material objects. Thus, they lost the opportunity not only to distinguish between the processes of transfer and transformation of energy, but also to explain the reasons for their occurrence. This applies to the exchange interaction conducted by the emission and absorption of "interaction carrier particles" (bosons), which can only carry out the transfer, but not the transformation of energy. Therefore, their claims to "fundamentality" are without foundation. Energy dynamics cuts this drawback by returning to physics the concept of work W_i and force $\mathbf{F}_i$ in their most general understanding. In this case, the force $\mathbf{X}_i$ takes on the meaning of the intensity of gravitational, electric, magnetic, temperature, etc. fields. This leads to the understanding that any force field $\mathbf{X}_i(\mathbf{r})$ is generated not by masses, charges, and currents themselves, but by their uneven distribution in space. In other words, it is not the scalar, vector, or tensor fields, which are only functions of the distribution of energy carriers in space[19] that are material but the energy carriers themselves.

Consideration of mechanics because of energy dynamics makes it obvious that Newton's definition of force:

$$\mathbf{F} = d\mathbf{P}/dt. \qquad (7)$$

Refers only to the process of acceleration and is by no means a general definition of the concept of force.

Deciding the force of any i-th nature $\mathbf{F}_i$ or $\mathbf{X}_i$ as a derivative of the energy U based on the displacement $d\mathbf{R}_i$ of the center of the energy carrier Θ_i makes any force a consequence of the spatial inhomogeneity of the potential field ψi of the system. Along with this, identity (3) gives a unified definition of accelerating, centrifugal, long-range, and short-range forces of various natures, appearing in mechanics, thermodynamics, hydro-aerodynamics, electrodynamics, etc.[4]

At the same time, thanks to the generalization in energy dynamics of the concepts of "technical" and "disposable", "useful" and "dissipative", "external" and "internal", "mechanical" and "non-mechanical" (including "thermal" associated with the acceleration of chaotic movement), "ordered" and "disordered" work, it is possible to return energy to its original meaning as a measure of the system's performance, defining it as "the most general function of the state of the system, characterizing its ability to perform any work." This is very close to Maxwell's definition of external energy as the sum of all actions that a system can perform on its environment, and it is all the more necessary that, as Nobel laureate R. Feynman admitted, "Today's physics does not know what energy is".[19]

Incompatibility of Newtonian and relativistic definitions of mass

According to identity (3), the inertial force Fa, which prevents acceleration, is defined as the derivative of the kinetic energy $U_k = M\upsilon^2/2$ with respect to the mass displacement vector $d\mathbf{R} = d\mathbf{r}$

$$\mathbf{F}_a = -\partial U^k/\partial\mathbf{R} = -M\,\boldsymbol{\upsilon}\cdot\nabla\boldsymbol{\upsilon} \qquad (8)$$

It is easy to notice that this force is opposite in sign to the accelerating force F in Newton's law (7) and goes into the expression $\mathbf{F} = M\boldsymbol{a}$ only when M = const and $\boldsymbol{a} = \boldsymbol{\upsilon}\cdot\nabla\boldsymbol{\upsilon}$. This means, firstly, that the interpretation of mass M in Newton's 2nd law as a measure of inertia is completely unfounded - Newton strictly adhered to his definition of mass as "a measure of the amount of matter proportional to its density and volume.[1] At the same time, expression (8) shows the need to clarify the concept of acceleration a, erroneously defined in mechanics as the total derivative of speed with respect to time dυ/dt. To verify this, let us imagine dυ/dt, as usual, as the sum of the local (∂υ/∂t)r and the convective part $(\boldsymbol{\upsilon}\cdot\nabla)\boldsymbol{\upsilon}$. Since it is impossible to accelerate a body without moving it in space, $(\partial\boldsymbol{\upsilon}/\partial t)_\mathbf{r} = 0 = 0$, and $\boldsymbol{a} = (\boldsymbol{\upsilon}\cdot\nabla)\boldsymbol{\upsilon} = \nabla(\upsilon^2/2)$. Consequently, acceleration is caused solely by a change in the kinetic energy of the body, which occurs during both translational and rotational motion. The latter is extremely important, since in classical mechanics, accelerated is also understood as the uniform motion of a body in a circle, predicting on this basis the inevitable fall of an electron onto an atomic nucleus. In this case, acceleration a appears in a new light as a shift in the velocity field $\boldsymbol{\upsilon}(\mathbf{r}, t)$ towards its intensification, and not just as an increase in the speed of an individual body.

Thus, Newton's law really requires adjustment, but not at all related to the relativistic increase in mass. It is known that classical mechanics dealt with conservative systems, that is, it neglected dissipation. In this case, the only consequence of the action of force **F** was the acceleration a, so the proportionality coefficient between it and the rate of change of momentum dP/dt in (7) was equal to unity and could be omitted. However, in nonequilibrium polyvariant systems, under the influence of the force Fi, along with acceleration, the impulses $\mathbf{J}_j = d\mathbf{P}_j/dt$ (flows) of other energy carriers also change. In the thermodynamics of irreversible processes (TIP), this is considered by writing phenomenological laws in the form[6]:

$$\mathbf{F}_i = \Sigma_j R_{ij}\mathbf{J}_j\,, \qquad (9)$$

Where R_{ij} are the so-called phenomenological coefficients that characterize the resistance of the i-th force from the j-th flow. It can be shown that these coefficients are functions of the efficiency η_j of the corresponding energy conversion process, defined as the ratio of the power $N_j = \mathbf{F}_j\cdot\mathbf{J}_j$ at the output of the converter to the power $N_i = \mathbf{F}_i\cdot J_i$ at its input:

$$\eta_j = N_j/N_i\,. \qquad (10)$$

From these positions, let us consider the process of acceleration of a charged particle ($\mathbf{J}_j = d\mathbf{P}/dt = M\boldsymbol{a}$) in a cyclotron under the influence

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of an external (electromagnetic) force $\mathbf{F}_i$. If Newton's law $\mathbf{J}_j = \mathbf{F}_j$ can be generalized to processes of a different nature ($\mathbf{J}_i = \mathbf{F}_i$), we find following (10) that $\mathbf{F}_j / \mathbf{F}_i = \eta_j^{1/2}$, i.e.

$$\mathbf{F}_i = \eta_j^{1/2} d\mathbf{P}/dt . \qquad (11)$$

Expression (11) considers the inevitable losses during the acceleration process (the irreversibility of this process). As we approach the maximum speed of propagation of disturbances in any medium (in this case, the speed of light c), $d\mathbf{P}_a/dt \to 0$, and $R_{ij} \to \infty$. This is since when the maximum speed of a material object is reached, no force F can lead to its further increase. Consequently, equations (9) and (11) are nonlinear, which makes the introduction of coefficients R_{ij} necessary. This is revealed with clarity in the energy-dynamic theory of conversion of various forms of energy, where the coefficients R_{ij} turn out to be related to the efficiency of energy converters. These efficiencies vanish twice: when the plant is "idling," when it produces no useful power, and when it is "short-circuited," when all the power it generates is dissipated in the form of heat. In charged particle accelerators, this corresponds to the particles reaching their maximum speed, when all the power supplied to them is spent on replenishing losses. These considerations fully apply to Kaufman's experiments on electron acceleration.[20]

Thus, as speed increases, it is the efficiency of the acceleration process that changes, not the accelerated mass. It is especially easy to verify the inadmissibility of a relativistic change in mass with a speed v from the standpoint of the law of conservation of mass of an isolated system. Whatever processes occur in such a system, including processes of relative acceleration or deceleration of the components of the system, mass as a measure of the amount of matter contained in it stays unchanged. Therefore, its artificial division into "rest mass" and "relativistic," "inertial" and "gravitational," "longitudinal" and "transverse," "electromagnetic" and any other means a rejection of the principle of distinguishability of processes and the replacement of the law of conservation of energy with the principal "interconversion" of the masses.

Inconstancy of the speed of light

The postulate about the constancy of the speed of light in emptiness, known since the time of Epicurus, assumes the existence of space free from the material environment, since otherwise its properties would certainly influence this speed. Even the presence of a gravitational field as an immaterial medium affects it, which has been known since the time of D. Michel (1783) and still serves as the basis for postulating the existence of gravitational "black holes". And the assumption about the existence of "empty" space, which takes us back to the times of Epicurus, does not stand up to criticism. In fact, if there are at least some material objects in space that exchange radiant energy with each other, then it is no longer empty. Even the curvature of the trajectory of rays (lensing phenomenon), recognized by general relativity, shows a change in the velocity vector. Finally, no matter what we imagine radiation to be - ether, physical vacuum, field, gas of photons, hidden matter, etc. - it also fills all space, which by virtue of this alone is "non-empty." Therefore, we can only talk about the independence of the speed of propagation of radiation in a luminiferous medium, no matter what the mechanism of its transfer (wave or corpuscular) may be. In this case, we cannot exclude from consideration the intergalactic medium in which this light propagates. With this formulation of the question, the contradiction of the mentioned postulate with experimental data is at once revealed. Indeed, according to the theory of oscillations,[21] confirmed in a huge number of cases, the square of the speed of propagation of disturbances (in this case, the speed of light c) is determined by the partial derivative of the energy density of elastic deformation of the medium of propagation of disturbances ρu by its density ρ:

$$c^2 = \partial \rho_u / \partial \rho. \qquad (12)$$

This derivative is equivalent to the partial derivative (∂U/∂M) in identity (3), which is decided under the conditions of constancy of all other arguments of energy U, including the volume of the system V. Therefore, expression (12) is valid for any material media with elasticity. However, this derivative cannot "a priori" be considered independent of the density and other parameters of the intergalactic medium, especially under conditions when its local density changes by many orders of magnitude. This speed cannot be considered constant from the standpoint of the corpuscular theory of light, since it depends on the frequency of their "collision," i.e., on the radiation density. It is also easy to distinguish the light of a moving source from a stationary one, since due to the Doppler Effect its frequency will be different. Thus, the assumption of the constancy of the speed of light contradicts centuries-old ideas and cannot be accepted without evidence. This becomes even more obvious if we consider the difference in the mechanism of interaction transfer (propagation of disturbances) in different media. This is exactly how this question was posed by Laplace (1805), who, based on the fact of the stability of the solar system, showed that the speed of propagation of gravitational interaction cannot be lower than $5 \cdot 10^7$ speeds of light.[22] The existence of strange radiation in the Universe, different from optical radiation, was first experimentally discovered by Russian astrophysicist N. Kozyrev (1948) from photographs of the star Orion taken with the telescope's metal shutters closed. This radiation arrived significantly earlier than light in its optical range.[23] In the nineties, this result was confirmed by a group of RAS researchers.[24] In the fifties, the founder of astrospectroscopy A.A. Belopolsky discovered that the spectrum of light shifts near bright stars, which showed a change in the speed of electromagnetic waves depending on the properties of the environment.[25] The interstellar dispersion of the speed of EM waves discovered by him was also after confirmed several times. It turned out that EM waves with a frequency below 100 KHz have a speed significantly lower than $3 \cdot 10^8$ m/s.

In the sixties, the variability of the speed of light was discovered during radar observations of Venus. With a radar error of ±1.5 km and a maximum experimental error of 260 km, due to the rotation of the Earth, the scatter in the measurement data for the speed of light in various parts of its orbit was 2000 km.[26] Another phenomenon illustrating the possibility of exceeding the speed of light was the so-called "tunnel effect".[27] In particular,[28] reports an experiment in which a laser beam left a chamber with cesium vapor before it completely entered it. This phenomenon is interpreted because of "saving time" by choosing the shortest path. During the last decades of the 20th century, radio and X-ray telescopes discovered many objects (quasars and galaxies) in deep space that eject jets of matter at speeds several times higher than the speed of light. Other phenomena were discovered in which "superluminal" speeds could even be measured.[29] Completely unexpected was the discovery of Dr. R. Santilli (2016), who designed a telescope with concave lenses and used it to obtain multiple images of the same star at different points in the orbit in the form of a "pearl necklace" due to the difference in the speed of propagation of radiation.[30]

There is no less evidence of light slowing down. In 1982, the Australian scientist B. Setterfield drew attention to the monotonous decrease in the measured speed of light over the past three hundred years.[31] Another strange phenomenon was discovered using the

MAGIC telescope by an international group of researchers of the Markarian 501 galaxy. Astronomers "sorted" the gamma-ray photons arriving from there with each flare into low- and high-energy ones and found that with simultaneous emission, high-energy particles arrive with a delay of about 4 minutes.[32] In 1999, a scientific article was published in Natura detailing an experiment in which the speed of light was reduced to seventeen meters per second.[33] Nevertheless, the "scientific community" persists in not recognizing the material environment, which is not reducible in its properties to ordinary visible (baryonic) matter, preferring to it "emptiness" covered by the fig leaf of "physicality."

Non-equivalence of mass and energy

According to relation (12), which follows from the theory of oscillations, the square of the speed of propagation of disturbances in elastic media is decided by the partial derivative of the energy density of this medium ρu with respect to the density of this medium itself ρ. This means that this derivative depends in principle on all other arguments of the energy of this medium, including its density ρ, temperature T, composition, etc. Only for media in which density ρ is the only state variable, the partial derivative $(\partial\rho u/\partial\rho)$ goes into the full $d\rho u/d\rho$, the integration of which, considering $E = \int\rho u\, dV$ and $M = \int\rho dV$, leads to the expression

$$E = Mc^2. \qquad (13)$$

Such a luminiferous medium, in the minds of physicists of the 19th century, was the ether as an elastic medium with a non-zero density ρ, the vibrations of which propagate at the speed of light c. Therefore N.A. Umov back in 1874, on the basis of the law of conservation of energy and mass of a system consisting of a radiating body and ether, connected the decrease in the total energy of the body dE and its mass dM during the radiation process with an increase in the kinetic energy of vibrations of the ether $dE_k = (c^2/2)dM$, obtaining the relationship between them is of the form[34]:

$$E = Mc^2/2. \qquad (14)$$

In 1881, V. Thomson derived a similar expression dE = (3/4) c2dM, considering the ideas of that time about the existence of an "electromagnetic mass" of electrons.[5] The currently accepted expression

$$E = Mc^2. \qquad (15)$$

Was obtained by O. Heaviside (1890) based on the idea of the flow of radiant energy in the ether as the product of the light pulse P = Mc and its speed c.[35] A. Poincare (1900) and F. Hasenorl (1904) came to the same conclusion. A. Einstein in 1905 extended this expression to any form of energy, postulating the constancy of the speed of light and calling expression (17) the "equivalence principle" of mass and energy.[36] According to it, anybody with energy E (including a photon) has a mass $M = E/c^2$, which increases not only with an increase in the kinetic energy of the material system, but also with any form of its rest energy E_o. And vice versa, an increase in any form of energy of the system E entails an increase in its mass M. In connection with this, the concepts of "relativistic mass" M_r, "rest mass" Mo, "inertial," "electromagnetic," "gravitational" and etc. mass.

This classification is based on the use of the Planck system of units (where c = 1), which makes each form of energy U_i equivalent to the mass M_i of its energy carrier Θ_i. Meanwhile, it is known that any form of energy has quantitative and qualitative measures, that is, it is characterized not only by the value Θi, but also by the corresponding potential ψ_i, so that the equivalence of energy E to mass M does not yet mean the equivalence of Ui to mass M_i. This circumstance reveals the complete inconsistency of replacing the additivity of partial energies U_i with the additivity of their masses M_i. A different conclusion follows from the energy dynamics of isolated systems. It goes ahead from the fact that all forms of ordinary (baryonic) matter of the Universe are the product of "condensation" of nonbaryonic (hidden, unobservable) matter, no matter what we call it - ether, electromagnetic field, physical vacuum, photon gas, etc. This the motionless material medium has a single (gravitational) form of energy, depending on its density ρ. For such a medium, the partial derivative $\psi_m = (\partial U/\partial M)$, which decides the gravitational potential of the system, goes into the total derivative $\psi_m = dU/dM$, its integration leads to the expression

$$U = \psi_m M. \qquad (16)$$

Since in an isolated system $U = E_o$ and $M = M_o$, and under conditions of constant volume of the system, expression (16) can be written in the form

$$E_o = c^2 M_o. \qquad (17)$$

An increasing number of researchers are currently inclined towards this expression, however, believing that the speed of light is constant.[37] Mass in this expression does not change with speed, becoming, according to Einstein, a measure of the energy stored by a body. However, in the more general case of the intergalactic medium as a carrier of light, the speed of propagation of disturbances (oscillations) in it, by experience, becomes different, which leads to a violation of the principle of equivalence of mass and energy.

Non-geometric nature of gravity

According to identity (3), not only gravitational, but also any other forces disappear when the energy carrier is uniformly distributed in space. This situation is also true for velocity fields, as follows from expression (8). Let us now show that it does not contradict I. Newton's law of gravitation $F_g = GmM/R^2$, according to which the gravitational potential ψg at a distance R from the center of the "field-forming" body of mass M is decided by the expression:

$$\psi_g = -GM/R, \qquad (18)$$

Where G is the gravitational constant.

Since in intergalactic space with a continuously distributed mass there are neither "field-forming" M nor "test" masses m ≪ M, let us consider a sphere of unit volume V_o with radius Ro and mass $_{Mo} = \rho V_o$. For it, potential (15) at any point on its surface is equal to:

$$\psi_{go} = -(GV_o/R_o)\rho. \qquad (19)$$

From (19), in view of the constancy of (GV_o/R_o), it follows that the acceleration of the gravitational field $g = -\nabla\psi_g$ can be represented as a function of the density of the intergalactic medium:

$$\mathbf{g} = (GV_o/R_o)\nabla\rho = \psi_{go}\nabla\rho/\rho, \qquad (20)$$

Where $\psi_{go} = G\rho V_o/R_o$ is the Newtonian gravitational potential on the surface of a sphere of unit volume, equal in the SI system to ~ 10^{-34} m^2 s^{-2}.

A similar conclusion about the proportionality of acceleration g to the relative density gradient of the medium ∇ρ/ρ follows from energy dynamics. Indeed, by identity (3) at $dR_m = -d\mathbf{r}$, the gravitational force $_{Fg}$ is decided by the energy gradient (∂U/∂r) U = c2ρVo and is equal to c2Vo∇ρ. In this case, $\mathbf{F}_g/V_o = \rho\mathbf{g} = c^2\nabla\rho$, and we arrive at a modified form of Newton's law:[38]

$$\mathbf{g} = c^2\,\nabla\rho/\rho. \qquad (21)$$

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Comparing expressions (20) and (21), we find that for the intergalactic medium with an average density $\rho \sim 10^{-24}$ kg m^{-3}, the acceleration of the gravitational field, determined by expression (21), is no less than 40 orders of magnitude greater than that found from Newton's law in form (20). This is explained by the fact that Newton's law of gravitation considers only the pair interaction of gravitating bodies, while (21) considers the interaction of all structural elements of non-baryonic matter. Thus, the modified Newton's law (21) confirms the presence in intergalactic space of a gravitational field that is not inferior in strength to the field of internuclear forces. The latter shows the unity of the nature of "strong gravity" and "strong interaction". The origin of gravity arising from energy dynamics because of the uneven distribution of matter in space was confirmed by recent studies of 240 galaxies of various types, according to which the distribution of ordinary (baryonic) matter in them closely correlates with gravitational acceleration.[39]

Along with the discovery of "strong gravity," this explains many processes observed in the Universe: the strengthening of inhomogeneities in the gravitational field ($\nabla\rho \neq 0$) when they arise spontaneously; the presence of baryon acoustic oscillations in the intergalactic medium;[40] the presence in the Universe of vast regions (voids) free from baryonic matter (which is due to "gravitational equilibrium" ($\nabla\rho = 0$), i.e., the absence of conditions for densification of the intergalactic medium; ordered distribution of galaxy clusters in the form of concentric circles;[41] their expansion with the predominance of repulsive forces ($\nabla\rho < 0$); densification of regions with the predominance of gravitational forces ($\nabla\rho > 0$); the formation of "black holes" in areas of increased density; from non-baryonic (unobservable) matter in the centers of galaxies; the appearance of "jet" when baryonic (emitting) matter appears in them; the presence of an invisible halo on the periphery of galaxies; the gradual weighting of planets as interstellar matter accretes on them; stars of thermonuclear reactions; gradual weakening of gravitational forces as stars become denser; explosion of "supernovae" when internal pressure in stars exceeds gravitational forces, and much more.[42] All this favorably distinguishes the energy-dynamic theory of gravity from general relativity, which generates more mysteries than it provides answers.

Discussion of results

Back in 1632, in the book "Dialogue on the two most important systems of the world - Ptolemaic and Copernican," Galileo noted as a fact that if on a ship moving rectilinearly and evenly a stone is released from the mast, then it falls in the same way as on a stationary ship - to the foot of the mast. It followed that in the hold of a ship floating uniformly and in a straight line, no experiments could detect its movement compared to the water environment and land. This position, which received the name "Galileo's principle of relativity" in mechanics, said that the uniform and rectilinear motion of one system of material bodies relative to another does not at all affect the course of mechanical processes occurring inside these material systems. It is easy to see that this principle of Galileo reflects the in distinguishability of the state of rest or motion of a ship when it moves "by inertia." Indeed, according to the latter, the state of a rectilinearly and uniformly moving mechanical system is characterized by only two parameters: momentum P and the position of the center of mass of the body or system of bodies R. In this case, this in distinguishability is due simply to the invariance of these parameters in the reference system associated with it, since in both in each case, the same forces act on the system. It was this circumstance that I. Newton put into the basis of his 1st law, formulating it as follows: "everybody continues to be kept in a state of rest or uniform and linear motion until and unless it is forced by applied forces to change this state".[9]

A/Poincare in 1895 extended this principle to electromagnetic phenomena, calling it the postulate of relativity. According to him, not only mechanical, but also electromagnetic experiments carried out within an arbitrary reference system cannot establish the difference between states of rest and uniform rectilinear motion. Naturally, in such FRs, called inertial, the physical laws will necessarily have the same form. However, it did not at all follow from this that these laws should have the same form in other, non-inertial FRs. This is most objects in the Universe in which rotational motion is seen. The principle of relativity does not apply to the speed of light in a vacuum, since postulating its independence from the direction in space and from the movement of its sources is a recognition of its absoluteness. This entailed the need to search for precisely those FRs in which the states of motion and rest would be easily distinguishable. Meanwhile, A. Einstein in 1905 preferred the diametrically opposite path and extended the postulate of relativity to all natural phenomena, placing it at the basis of the special theory of relativity (STR). Soon he also formulated the principle of local in distinguishability of gravitational forces and inertial forces, calling it the principle of equivalence of inertial and gravitational masses and placing it at the basis of the general theory of relativity (GTR). Then it was joined by the principle of in distinguishability of accelerated and rotational motions, which extended the in distinguishability of the dynamic effects of acceleration and gravity to non-inertial frames of reference. Thus, the principle of the in distinguishability of rest and uniform rectilinear motion in inertial reference systems became the main first principle of the theoretical construction of all physics and scientific research. In electrodynamics this was expressed in the principle of the in distinguishability of electrons in a metal; in particle physics – in principle, the in distinguishability of identical particles; in QED – in the in distinguishability of matter and field; in a unified field theory - in a statement about the possibility of merging together (up to complete in distinguishability) at least three of the four known types of interaction. And all this was done based on extrapolation of Galileo's principle, which is valid only for inertial systems. As a result, Leibniz's well-known idea about the absence in nature of two completely identical things, as the original formulation of the principle of distinguishability of energy dynamics, was supplanted by its antipode - the principle of in distinguishability. His postulation made understanding of physical processes unnecessary and illusory and gave rise to a lack of distinction between truth and error.

Meanwhile, neither from the principle of relativity of Galileo-Poincare-Einstein, nor from experimental practice did it follow that physical laws should be formulated in such a way that rest, and uniform rectilinear motion of the system were indistinguishable. On the contrary, from this practice arose the preference to formulate these laws in such a way that their form was as simple and understandable as possible, and, if possible, would not depend on RS. These are RS, in which the space filled with matter stays motionless and does not take part in the processes occurring in it. This is precisely the space occupied by an isolated system, the center of which coincides with the center of mass, inertia, charge, entropy, and any other extensive parameter of state with a uniform (equilibrium) distribution of its density over this space. Due to the principle of self-non violation of equilibrium, known as the zero law of thermodynamics,[1] this situation cannot be changed in any way. In such a system, the role of ARF can be performed by any material object that does not change its position relative to the center of its volume. In it, it is impossible to confuse the relative movement of one of the bodies when it falls onto another with its acceleration, since the first is accompanied by a change in the position of the center of mass of the entire system relative to the center of its volume, and the other by a displacement of its center of inertia.

With this approach, the question of the presence of "ethereal wind" and the degree of its local entrainment by bodies recedes into the background, to the problem of its viscosity. On the contrary, the question of the unity of principles and laws of various scientific disciplines in ARF buys fundamental importance. This is exactly what A. Poincaré insisted on in his demand for the unity of the form of recording physical laws, rightly emphasizing that otherwise a theory explaining one area of physical phenomena will inevitably come into conflict with facts corresponding to another area of phenomena.[8] This is what happened when the violation of the correspondence between mechanics and electrodynamics became the cause of a deep crisis in physics. Looking back at the historical past, it is difficult to understand the logic of finding clearly distinguishable concepts and then, based on their in distinguishability, replacing gravitational forces with the curvature of space and thereby turning the arena into a participant in the performance. In this regard, the energy-dynamic approach to the problem of gravitation is a noteworthy alternative to TR, marking the return of physics to the classical path of development.[43]

Conclusion

The concept of in distinguishability of processes, hidden behind the principle of relativity, deprives it of heuristic value. This principle aims to find conditions that make processes indistinguishable instead of identifying their specificity and suggesting ways of studying complex processes. Its postulation made understanding of physical processes optional and largely illusory and ultimately gave rise to the inability to distinguish between truth and error. This can be explained using the example of the same Galileo's principle. Even in those days, sailors found a way to distinguish between the rest and motion of a ship relative to invisible shores and the bottom by throwing an anchor over the stern. To establish whether our planet rotates, while in the closed space of a temple, Foucault's pendulum was enough. The light of a moving source can be distinguished from a stationary one by comparing their spectrum. It is possible to distinguish the uniform motion of a vessel with gas at near-light speed from its state of rest by the weakening of gas diffusion in it together with Brownian motion, which ceases with the onset of the maximum speed. It is possible to establish whether a stone fell on the Earth or the Earth on a stone by the nature of the destruction. In short, the in distinguishability of the states of rest and motion is not so obvious that it could be taken as a postulate or axiom. Moreover, from the very fact of their in distinguishability it did not follow that physical laws should be formulated not in the simplest and most understandable way, but in such a way that their form remains invariant in any inertial frame of reference. This requirement is unjustified if only because the predominant form of motion in the multiverse is rotation, for which there is a preferred frame of reference associated with the instantaneous center of inertia. Moreover, the requirement to find the IFR is theoretically unrealizable, since we will never have a way to verify that any IFR moves uniformly and in a straight line. Since there is no possibility of experimentally confirming or refuting the existence of the IFR in each specific case, the theory based on it does not meet Popper's criterion of scientific.[32] From this standpoint, the requirement of invariance of the Poincaré-Lorentz-Einstein physical laws in the IFR looks rather strange, to say the least. In this regard, the energodynamic approach is a noteworthy alternative to RT, marking the return of physics to the classical path of development. In any case, energodynamics, which does not need the IFR, can serve as a "touchstone" for any relativistic theory.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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