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Local cycles of the universe

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Abstract

The concept of the "dynamic Universe" is presented, in which the circulation of the continuum and corpuscular phases of matter with their inherent forms of energy. This process includes evolutionary and involutionary stages, the first of which begins with wave formation in the "hidden" (unstructured) part of the matter of the Universe and the transition of its "gravistatic" (potential) energy into "gravidynamic" (oscillatory) with the formation of a structured (baryonic) matter, its further compaction and complication, the formation of small and large celestial bodies, the occurrence of thermonuclear reactions in the latter, and an increase in pressure. The second stage includes their "explosion" of supernovae because of the violation of their stability, the later "big gap" and the return of matter to its original state. This circuit, occurring spontaneously in various regions of the infinite Universe, allows it to function in time and space indefinitely, bypassing the state of equilibrium. The data of astronomical observations are presented, confirming the proposed alternative to the "Standard Model" concept.

Key words: Dynamic Universe; Evolution and Involution; Baryonic and Non-Baryonic Matter; Circulation of Matter in the Universe; Formation and Decay of Matter; Wave Nature of the Universe.

1. Introduction

Revolutionary discoveries in astronomy and astrophysics, made in recent decades due to the improvement of technical means of observation, reliably set up the existence along with ordinary (observable, baryonic) matter of the "hidden mass" of the Universe, which makes up at least 95% of its total amount [1]. This means that until now, science has studied no more than 5% of the matter of the Universe, and all the laws of natural science that seemed "universal" to it refer precisely to this insignificant part of it.

Nevertheless, tries to extrapolate these laws to an isolated Universe as to the entire set of interacting (mutually moving) material objects have not been abandoned so far. Starting with the "principle of increasing entropy" by R. Clausius, who imposed on her the "arrow of time", such attempts were continued in the concept of the birth of the Universe from a single "cosmological singularity" (a material point with an infinite value of density and temperature) through its "Big Bang" followed by its "inflationary" (incalculably fast) expansion and cooling. The inconsistency of this model follows at least from the fact that, according to thermodynamics, the expansion into the void is not accompanied by the performance of work and a decrease in the internal (intrinsic) energy of this singularity, and, so, its temperature. However, supporters of this "Standard Model" even admit the possibility of the emergence of the Universe in the absence of its energy ("out of nothing") on the grounds that its "gravitational energy is negative and exactly compensates for the kinetic one" [2]. This shows not only that "modern physics does not know what energy is" [3]), but is also in a crisis, since the absence of energy is incompatible with the law of its conservation. The more important is the opportunity to offer an alternative to the "Standard Model", based on a unified theory of the processes of transfer and transformation of any form of energy, called for brevity "energodynamics" [4] and now recognized as a "new direction in science" [5], as well as on the one discovered in within its framework, the law of gravity in continuous media [6].

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2. The inevitability of the emergence of local ethereal cycles of the Universe

The modern paradigm of natural science divides matter into substance and field. Such a division is unsatisfactory, if only because fields (scalar, vector, and tensor) are present in matter as well. Therefore, energy dynamics distinguishes between the real (corpuscular) and field (continuum) forms of matter, assuming the former to be structured (baryonic) and the latter to be unstructured (non-baryonic). Such a division of matter corresponds to modern data of observationnnal astronomy [1], which discovered the existence of a "hidden mass" in the Universe as a synonym for "ether", expelled from the theoretical physics of the twentieth century "as unnecessary", and after A. Einstein recognized its necessity for general relativity - replaced even more indefinite entities such as "physical vacuum", "dark matter", "dark energy", "quintessence", etc.

Energodynamics [4] not only recognizes the existence of aether as a "primary" form of matter (prematter), from which all types of matter in the Universe were formed in evolution, but also considers it an indispensable (initial) part of any material system. This follows from the "principle of counter-direction of real processes", which is fundamental for energodynamics. To prove it, it is enough to express any extensive parameter of the system Θ_i (its energy U, mass M, number of moles of k-th substances N_k, entropy S, electric charge Z, impulse $\mathbf{P}$, its momentum $\mathbf{L}$, etc.) by an integral of its local $\rho_i = d\Theta_i/dV$ and average density $\overline{\rho}_i = \Theta_i/V$ by an expression like $\Theta_i = \int \rho_i \, dV = \int \overline{\rho}_i \, dV$. It at once follows from this that:

$$\int [(d \, (\rho_i - \overline{\rho}_i)/dt] \, dV \equiv 0. \qquad (1)$$

It is easy to see that identity (1) is satisfied when any real processes $(d(\rho_i - \overline{\rho}_i)/dt \neq 0)$ occur in the system only if their speed is opposite at least in a number of elements of its volume dV, i.e. when these processes in different parts (areas, phases or components) of the system are opposite. This position is of a universal nature and therefore was called by us the "principle of the opposite direction of processes". It reflects the dialectical law of unity and struggle of opposites [7] and can serve as its mathematical expression.

This principle excludes the possibility of both the emergence of any i-th macroprocess in systems that have reached equilibrium (where the difference $(\rho_i - \overline{\rho}_i)$ is everywhere equal to zero), and the one-sided direction of the processes occurring in them (when their speed $d(\rho_i - \overline{\rho}_i)/dt$ is everywhere has the same sign). This excludes the possibility of accepting any postulates about the homogeneity of the material space or any system. This concerns not only any i-th form of partial energy $U_i(\Theta_i)$, but also its energy carrier Θ_i (including mass) and requires the cosmogony of the Universe.

The modern "Standard Model" allows the emergence of the Universe from a certain "singularity" with an infinite value of its inherent parameters due to reasons unknown to science. In this case, $\rho_i - \overline{\rho}_i < 0$ at any time since the beginning of the "Big Bang", which is incompatible with identity (1) even in the case when the "expansion" of the Universe occurs unevenly. If this circumstance were considered in the "equation of the Universe" of Einstein - Friedman [8]:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = 8\pi G \mathbf{T}_{\mu\nu}, \qquad (2)$$

which connects the space-time curvature tensor $G_{\mu\nu}$ from its own energy-momentum tensor $\mathbf{T}_{\mu\nu}$, then it would become obvious that it should be represented as an integral (1), i.e., considering the inhomogeneity of its mass distribution. Then the results of his mathematical analysis by Friedman would not refer to the Universe as a whole, but to any of its regions, phases, or components, allowing for the possibility of expansion of some and contraction of other parts of the Universe. Such a (dynamic) nature of the development of the observed part of the eternal and infinite Universe is quite natural and, in principle, verifiable, which cannot be said about it. When the "compression" of galaxies under the influence of their gravity, the expansion in them of the so-called. "voids" (areas of the Universe free from celestial bodies), which looks like a "retreat" of the outer boundaries of galaxies (we see something similar in the behavior of fat spots on the surface of a liquid). The details of such "existence" of the Universe are considered by the energy-dynamic theory of evolution and involution of the Universe [9].

3. Elements of the energy-dynamic theory of evolution and involution of the Universe

The proof of the principle of opposite direction of processes was the impetus for understanding the heterogeneity (internal non-equilibrium) of any material system as a necessary condition for the emergence of any macroprocesses

in it. This also applies to two forms of matter in the Universe: real (baryonic) and field (non-baryonic). If we denote their density by the latter through ρ_u' and ρ_u'', then the internal energy of the Universe U can be represented as the sum $U = \int (\rho_u' + \rho_u'') \, dV$, so that, by virtue of its conservation law, we have:

$$d\rho_u'/dt = -d\rho_u''/dt. \qquad (3)$$

Since evolution as (appearance of new properties in the system, its complication, etc.) is accompanied by an increase in its energy, then the law of conservation of energy (3) directly implies the inevitable simultaneous occurrence in any isolated system of oppositely directed processes of evolution and involution, obeying the criteria:

$$d\rho_u/dt > 0 \text{ (evolution)}; \quad d\rho_u/dt < 0 \text{ (involution).} \qquad (4)$$

Thus, the simultaneity of evolution and involution in different parts (regions, phases, components) of a single system is a law of nature [10]. To follow these processes in space, we consider that the ether is a medium with a minimum number of degrees of freedom and energy forms. By the method of elimination, it is easy to conclude that for the hidden mass as a synonym for ether, which has no signs of electromagnetic interaction and the properties of an all-penetrating medium, the only one of the 4 known types of interaction is only gravitational. The potential energy of this interaction for an inhomogeneous and generally immobile medium is gravitational. This circumstance is the starting point for the inevitable chain of later conclusions.

3.1. Energodynamic equation of the Universe

The heterogeneity of the systems under study, including the ether, requires the introduction of the missing extensive and intensive parameters of the heterogeneity. In energy dynamics, this is done by considering the deviation of the center position $\mathbf{R}_i$ of any energy carrier Θi from its equilibrium position $\mathbf{R}_{io}$, which are decided in a known way:

$$\mathbf{R}_i = \Theta_i^{-1} \int \rho_i \, \mathbf{r} \, dV; \quad R_{io} = \Theta_i^{-1} \int \overline{\rho_i} \, \mathbf{r} \, dV, \qquad (5)$$

where r is the running (Eulerian) spatial coordinate.

It follows from this that when the system deviates from a homogeneous ("internal equilibrium") state, a certain "moment of distribution" of the energy carrier arises:

$$\mathbf{Z}_i = \Theta_i (\mathbf{R}_i - \mathbf{R}_{io}) = \int (\rho_i - \overline{\rho_i}) \, \mathbf{r} \, dV \qquad (6)$$

with the shoulder $\mathbf{R}_i - \mathbf{R}_{io}$, which we called the "displacement vector" [4]. Since in equilibrium $\mathbf{R}_{io}$ coincides with the center of space, which does not take part in any processes, then $\mathbf{R}_{io}$ can be taken as a reference point and represent $\mathbf{Z}_i = \Theta_i \mathbf{R}_i$ as the sum of three independent components:

$$d\mathbf{Z}_i = \mathbf{R}_i \, d\Theta_i + \Theta_i \, d\mathbf{r}_i + d\boldsymbol{\varphi}_i \times \mathbf{Z}_i = d_\Theta \mathbf{Z}_i + d_\mathbf{r} \mathbf{Z}_i + d_\boldsymbol{\varphi} \mathbf{Z}_i, \qquad (7)$$

where $\boldsymbol{\varphi}_i$ is the spatial (Eulerian) angle of the vector $\mathbf{Z}_i$; $d\mathbf{r}_i$ is the shear part $d\mathbf{R}_i$ (at $\boldsymbol{\varphi}_i = \text{const}$).

These three components correspond to three independent categories of non-equilibrium processes: evolution/involution of the system (emergence and disappearance of energy carriers ($d_\Theta \mathbf{Z}_i \neq 0$); redistribution of energy carriers Θ_i over its volume ($d_\Theta \mathbf{Z}_i \neq 0$) and reorientation of the moments of their distribution $\mathbf{Z}_i$ in space ($d_\boldsymbol{\varphi} \mathbf{Z}_i \neq 0$). As a result, any i-th form U_i of the internal energy of the system $U = \Sigma_i U_i$ becomes in the general case a function of three independent parameters: $U_i = U_i (\Theta_i, \mathbf{r}_i, \boldsymbol{\varphi}_i)$. According to this, its total differential dU can be represented as an identity, which vanishes in isolated systems:

$$dU_{из} \equiv \Sigma_i \Psi_i \, d\Theta_i + \Sigma_i \mathbf{F}_i \cdot d\mathbf{r}_i + \Sigma_i \mathbf{M}_i \cdot d\boldsymbol{\varphi}_i = 0, \quad (i = 1, 2, I) \qquad (8)$$

where $\Psi_i \equiv (\partial U_i / \partial \Theta_i)$ are generalized potentials ψ_i averaged over the volume of the system (absolute temperature T and pressure p, chemical potential of the kth component of the system μ_k, its electric φ, gravitational ψ_g, etc. potential); $\mathbf{F}_i \equiv (\partial U_i / \partial \mathbf{r}_i)$ – generalized forces (external and internal, mechanical and non-mechanical, useful and dissipative); $\mathbf{M}_i \equiv (\partial U / \partial \boldsymbol{\varphi}_i)$ are the moments of these forces.

This identity is the result of the joint definition of "conjugate" parameters Ψ_i and Θ_i, $\mathbf{F}_i$ and $\mathbf{r}_i$, $\mathbf{M}_i$ and $\boldsymbol{\varphi}_i$ and its three sums describe the processes occurring in any of the material components of the Universe. A separate line in it is occupied by ether, which, due to its permeability, is the original (zero) part of any material system. Its other components characterize the processes occurring in the material components of the system, formed because of phase transitions ("condensation") of the ether and the acquisition by the system of new properties and new degrees of freedom (thermal, deformation, electrical, magnetic, chemical, etc.). In particular, the members of the 1st sum (8) describe the processes of occurrence in the system of k -th substances that were not previously present either in it or in the environment surrounding the system. This is due to the compaction and interference of ether waves, which will be discussed below. The terms of the 2nd sum describe the transfer of energy carriers Θ_i within the system, and in particular, the "flow" of matter from one galaxy to another, and the terms of the 3rd sum describe the reorientation of vectors $\mathbf{Z}_i$ in space and the rotation of galaxies with an angular velocity $\boldsymbol{\omega} = d\boldsymbol{\varphi}_i/dt$. Thus, identity (8) covers all categories of processes occurring in the Universe, so that it can be more justifiably called the "equation of the Universe" than relation (2).

3.2. Occurrence in the ether of acoustic density fluctuations

Since density ρ_o in a non-uniform ether is a function of spatial coordinates (radius vector $\mathbf{r}$) and time t, its total time derivative $d\rho_o/dt$ includes local $(\partial\rho_o/\partial t)_{\mathbf{r}}$ and convective $(\partial\rho_o/\partial \mathbf{r})(d\mathbf{r}/dt) = (\mathbf{v}_o \cdot \nabla)\rho_o$ component. It is easy to give this derivative the form of a "kinematic" equation of an undamped standing wave of aether density [11]:

$$\mathbf{v}_o^{-1}(\partial\rho_o/\partial t) + (\partial\rho_o/\partial \mathbf{r}) = 0, \qquad (9)$$

if we give the derivative $d\rho_o/dt$ the meaning of "its damping function" and consider its undamped character ($d\rho_o/dt = 0$).

Figure 1 Acoustic vibrations in space

The existence of such standing waves in outer space is confirmed by astronomical observations (Fig. 1). According to (9), local fluctuations in the density of the ether $(\partial\rho_o/\partial t)_{\mathbf{r}}$ are supported by the mass "draining" to it from the vicinity of the point with the speed $\mathbf{v}_o = d\mathbf{r}_o/dt$. This speed is decided by the density of the ether and is numerically equal to the scalar speed of light in it ($\upsilon_o = c$), which characterizes the 2nd term of expression (9). These ordinary acoustic waves are different from Einstein's "space-time" waves. However, their form differs from ordinary sinusoidal waves in that the amplitude of the "rarefied" phase of the wave ($\rho < \overline{\rho}$) is limited due to the extremely low density of the space medium ($10^{-32} \div 10^{-29}$ г см$^{-3}$), while for the positive phase waves ($\rho > \overline{\rho}$) there are no such restrictions. Therefore, the standing wave of the ether has the form of a wave of "elevation", like a tsunami on "shallow water". Such a solitary wave oscillates under the conditions $\rho > \overline{\rho}$, staying structurally stable, and therefore belongs to the category of solitons. The formation of such solitons in the ether and their compaction (an increase in their number in the same volume) leads to the formation of the so-called "group soliton" with increased density. In it, as the distance from the center increases, the amplitude of oscillations decreases, and their antinodes are in the zone of gravitational equilibrium ($\nabla\rho_o=0$). This is how atoms of future substances with many spherical shells are formed (Fig. 2). This is precisely the model of the Schrödinger atom, in which the number of such spherical shell waves grows with increasing mass of the nucleus. This model is supported by experiments that have shown that electrons in an atom behave as if they form elastic multilayer spherical shells around the nucleus [12].
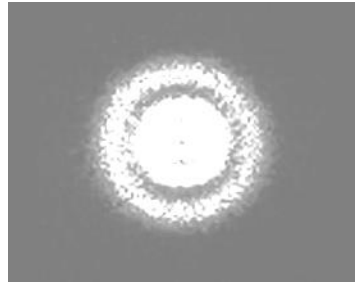
Figure 2 Photo of a hydrogen atom obtained in an electronic scanning

3.3. **Vibrational (gravidynamic) energy of aether**

The most important consequence of the appearance of fluctuations in the density of the ether is the realization of the appearance of kinetic energy in it. The carrier of this energy is, as is known, the impulse $P_o = M_o c$. Its change in the oscillatory process requires the application of Newtonian forces $F = dP_o/dt$ and the performance of work against the forces of inertia $W = \int F \cdot dr_o$, so that under the conditions $c = const$ the internal energy of the oscillatory motion of the ether is equal to

$$U_o = W = \int F \cdot dr_o = \int c \cdot dP_o = M_o c^2. \qquad (10)$$

This expression for the energy of the ether was obtained even before A. Einstein by H. Schramm (1871); N. Umov (1873); J. Thomson (1881); O. Heaviside (1890), A. Poincare (1898) and F. Hasenorl (1904) [13]. However, it became widely known thanks to the SRT of A. Einstein, who obtained it by expanding it into a series of relativistic expressions of mass related to any substance and called it the "principle of equivalence of mass and energy" [14]. This principle made it possible to realize that matter has huge reserves of "free" (suitable for doing useful work) energy. As applied to the ether, this principle means that its internal energy U_o, being gravidynamic in nature ($U_o = U_g = M_o c^2$), is, like the gravitational energy, a purely positive value, which excludes the possibility of their "compensation" assumed in [2]. It is from the transition of a part of the gravitational energy into the gravidynamic one, i. e. from the acquisition by the ether of the second degree of freedom, that the process of evolution begins in some part of the Universe.

The energy for such an evolution is supplied by the ether, during the condensation of a unit mass of which $\Delta U_o = c^2 = 931,5$ MeV/a.m.u. is released, which is at least two orders of magnitude higher than the energy of thermonuclear fusion. Therefore, not it, but the ether should be considered the true "fuel of the Universe." This conclusion is supported by the fact that the temperature in the solar photosphere, according to recent data, exceeds that in its core. This means the need to revise the entire energy concept of the Universe. In this regard, it is needed to find the law of gravity for continuum media, different from the Newtonian law, since neither "field-forming" nor "test" bodies can be distinguished in the continuum.

3.4. **The law of gravity for continuous media**

According to identity (8), any force F_i is decided by the derivative of the energy of the system U with respect to the radius vector r_i of its energy carrier, i.e., by the gradient ∇U_i of the energy U_i. For the ether as a continuum medium, it is more convenient to run with the concept of energy density $\varepsilon_g = dU_o/dV$, which, by (10), is equal to $\rho_o c^2$. From here it directly follows that under the conditions $\omega = const$ the strength of the gravitational field $X_g = dF_g/dV$ and the "acceleration of free fall" $g = X_g/o$ are decided by the expression [15]:

$$X_g = c_o^2 \nabla \rho; \quad g = c_o^2 \nabla \rho / \rho. \qquad (11)$$

According to this expression, the specific gravitational force g in the ether is proportional to the relative density gradient $\nabla \rho / \rho$ with a proportionality coefficient equal to the square of the perturbation propagation velocity in it. In this case, the gravitational force at a given point in space is co-directed to the density gradient $\nabla \rho$ in it, i.e., it can have a different sign depending on the sign of $\nabla \rho$. In the area where $\rho < \overline{\rho}$, and $\nabla \rho$ is directed towards the area of increased density, gravitational forces have the nature of the forces of "pushing" mass elements to it, and in the area $\rho > \overline{\rho}$ - on the contrary, the forces of "gravitation" to it.

In this regard, law (9) was called by us for brevity bipolar. It follows from it that gravitation is not "an innate property of matter, as it seemed to Newton, but is due to the uneven distribution of matter in space, including the latent mass (ether).

One of the confirmations of the law of gravity (11) is the correction of the rotational curves of spiral galaxies (Fig. 3). The discrepancy between the dependence of the rotation speed of the peripheral layers of the galaxy, predicted by celestial mechanics based on Newton's law of gravity (curve A) and its actual dependence obtained by observations of many spiral galaxies (curve B), is known. The theoretical curve went ahead from the equality of the Newtonian forces of gravity and centrifugal acceleration v^2/R. If we proceed from the bipolar law of gravity (11), which takes into account the presence of a density gradient $\nabla\rho$ in the galaxy, then this equality will have the form: $c^2\nabla\rho/\rho = v^2/R$, from which the condition for the constancy of the velocity of the peripheral layers (v/c) directly follows $(v/c)^2 = $ conset at $R(\nabla\rho/\rho) = $ const, where R is the distance to the center of the galaxy [16]. Thus, the case again turns out to be a neglect of the inhomogeneous density of matter in these galaxies.
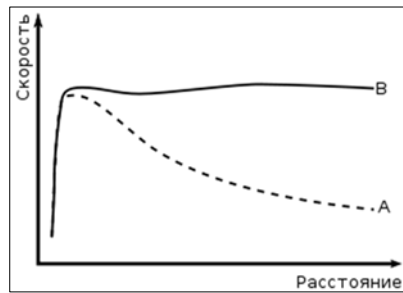
Figure 3 Rotational curves of spiral galaxies

Another confirmation of the validity of the law (11) is the existence of the so-called "gravitational funnels", i.e., individual "gravity zones" for large celestial bodies. It is known, for example, that the gravitational forces of the Moon to the Sun are twice those to the Earth. Nevertheless, the Moon revolves around the Earth without moving away from it. Newton's theory of gravitation cannot explain this. The bipolar law explains this with ease. According to him, between the two gravitating masses M_1 and M_2 there is a point of gravitational equilibrium (where $\nabla\rho = 0$), on both sides of which $\nabla\rho$ has the opposite sign. This is the boundary between two "gravitational wells", in each of which the sign of $\nabla\rho$ does not change, i.e., the gravitational force does not change direction. The more massive the body, the farther away from it is this "libration point". It follows that for small celestial bodies this point may be within the boundaries of the body itself. This explains the unsuccessful attempts to "land" spacecraft on them.

Figure 4 Concentric arrangement of star clusters

A new and important consequence of the bipolar law of gravity (9) is the existence of gravitational equilibrium in the region of space where $\nabla\rho = 0$. Its existence is confirmed by the concentric arrangement of clusters of stars and galaxies around the central cluster (Fig. 4) and compared to the "core" of the metagalaxy (in the center of the figure) at a certain distance from it in the form of cylindrical rings. This arrangement is since in the antinodes of these clusters, the gravitational forces $\mathbf{F}_g \equiv (\partial U_g/\partial \mathbf{r}_g)$ turn to zero according to the law (9), which means equilibrium in the absence of forces of a different nature in the ether. The latter is also confirmed by the absence of such clusters in the space between the central and peripheral clusters (in "voids"), where the "pushing" forces of galaxies and their clusters prevail. As a result, the "voids" expand, while the galaxies and their clusters, on the contrary, contract under the action of gravitational forces, which looks like their "recession" (Fig. 5). We see similar behavior with oil stains in a vessel of water. This is interpreted in the "Standard Model" as an "extension" of the already infinite Universe. The presence of "repulsive" forces cuts the need to introduce "dark energy" with negative pressure to explain the acceleration of this process.

Figure 5 Void of "Bootes"

However, the most striking proof of the validity of the bipolar law of gravity is the well-known phenomenon of matter flowing from one galaxy to another, known to astronomers, called "frame dragging". It is characterized by the fact that the nuclei of both galaxies, found in the antinode of the density wave, remain in place (contrary to Newton's law), while for their peripheral layers, which are outside it, the gravitational equilibrium is violated. As a result, one star or galaxy, which has a larger density gradient, seems to "undress" another, and not always a smaller one. In Fig.6 this is very clearly manifested in the thinning and heating of the jet of flowing gas from the right galaxy to the left.

Figure 6 Flow of matter to a galaxy with a lower mass

In addition, the energy-dynamic theory of gravity makes it possible to explain several other "mysteries" of the Universe [16]. All this allowed the Israeli Association of Inventors (IAI) to recognize the existence of a bipolar law of gravity (11) as a discovery [17].

3.5. Potential and driving force of wave energy exchange.

Until now, in the scientific literature, as far as we know, the question of finding the driving force of radiant energy exchange on a par with the phenomena of thermal conductivity, electrical conductivity, diffusion, etc. has not been raised. This is explained, on the one hand, by referring this type of energy exchange to radiant heat transfer, generated by the difference in absolute temperatures T, or ideas about the transfer of radiation by photons flying "by inertia" in absolute emptiness - on the other hand. However, such a representation does not stand up to criticism from either the wave or corpuscular point of view. Thermal radiation occupies only an insignificant part of the spectrum of oscillations with a wavelength from 0.4 to 4 microns, perceived by bodies as heat. Most of the radiation, which handles the phenomena of photosynthesis, the photoelectric effect, photoionization, photoluminescence, photoacoustic phenomena, photonuclear reactions, etc., is an ordered form of energy exchange and is in no way reducible to heat.

All these effects differ not in the nature of vibrations, but in how the substance perceives them. For example, an insignificant part of the oscillation range is dissipated by bodies and therefore leads to their heating. Thermal insulation or opaque screens protect well from this radiation. Another part of the radiation spectrum (in the range of radio waves) affects orbital electrons and generates electromagnetic oscillations in bodies. Electromagnetic shields (for example, a Faraday cage) protect against these radiations. At the frequency of X-rays, their influence weakens, and in the range of gamma radiation it becomes almost imperceptible. Such radiations cause nuclear rather than electromagnetic phenomena and should not be classified as EMP. Superhigh frequencies, characteristic of "highly penetrating", "thin", "torsion", etc. radiation, are absorbed by some polymer films that do not present practically any obstacles for electromagnetic radiation. Thus, it is the isolation method that serves as the basis for distinguishing between radiofrequency, infrared, thermal, visible, ultraviolet, x-ray, cosmic, etc. radiation. From these positions, only those radiations that are perceived by bodies as oscillations of charged particles and generate electromagnetic oscillations in them should be classified as electromagnetic. In this case, the rest is non-electromagnetic radiation, causing vibrations of uncharged particles. Recognition of the wave nature of such radiation, according to E. Schrödinger, "would greatly contribute to the achievement of the unity of our picture of the world" [18]. As for photons moving "by inertia" and carrying momentum, its absorption in "exchange interaction" can only repel, but not bring bodies closer together, which

is in blatant contradiction with the law of universal gravitation. Thus, radiant energy exchange requires the search for a driving force no less than the processes of heat conduction, electrical conduction, diffusion, etc.

To solve this problem, we use the well-known expression for the wave energy density ε_g [11]:

$$\varepsilon_g = \rho A_v^2 v^2 / 2, \qquad\qquad (12)$$

where ρ is the density of the medium carrying vibrations; A_v, v are the amplitude and frequency of the wave.

According to (12), $d\varepsilon_g = A_v v \, d(\rho A_v v)$. This expression corresponds to a single representation of heat transfer, mass transfer, work of expansion, etc. in thermodynamics as the product of the generalized potential ψ_i and the elementary change in the generalized coordinate of the i-th process $\Theta_i \equiv S, V, M_k, Z$, etc. [19]:

$$dW_i = \psi_i \, d\Theta_i. \qquad\qquad (13)$$

Comparing these expressions, we find that in the case of wave transfer of radiant energy, the potential is the intensive quantity $\psi_v = A_v v$, which we called the "amplitude-frequency potential of the wave" [20], and the carrier of radiant energy at the frequency v is the extensive quantity $\Theta_v = \int \rho A_v v \, dV$. In terms of energy dynamics, which runs with the concepts of thermodynamic force $X_i \equiv \nabla \psi_i$ and energy carrier flow $J_i = \Theta_i \upsilon_i$, the law of radiant energy exchange takes the same form as the equations of Fourier, Ohm, Fick, Darcy, etc.:

$$J_v = L_v \, X_v, \qquad\qquad (14)$$

where L_v is the coefficient of proportionality, which depends on the refractive index of the medium n_v and characterizes its optical density.

According to (14), a monochromatic wave flux in an absorbing or scattering medium propagates in the direction of decreasing wave potential ψ_v, and its density J_v is proportional to the gradient of this potential X_v. This circumstance is one of the reasons for the "redshift".

3.6. Elimination of the contradiction between the proposed theory of evolution and thermodynamics

Understanding the difference in properties and the opposite direction of processes in the non-baryonic and baryon phases of the matter of the Universe allows us to resolve several paradoxes mentioned at the beginning of this article. One of them concerns the problem of "thermal death" of the Universe, predicted by classical thermodynamics based on the principle of entropy increase [19]. This principle is generated by the substitution by R. Clausius of the true energy carrier of internal thermal energy, which is the momentum $M\upsilon$ known since Descartes, by a narrower concept of entropy S as a heat transfer coordinate [21]. If the amount of motion changed not only because of heat transfer, but also during work, then entropy as a heat transfer coordinate should be invariant with respect to it, which gave rise to this principle, since in real systems heat and work are mutually convertible and inseparable. As a result of this, there is still no rigorous proof of the entropy increase principle. Moreover, it can be shown that it is impossible in principle to prove it within the framework of equilibrium thermodynamics. For this purpose, let us consider a rather general case of a thermomechanical system for which the entropy S is one of the independent arguments of the internal energy U (along with its volume V), i.e., $U = U(S, V)$. Then, considering the entropy as an inverse function of its state $S = S(U, V)$, we at once conclude that in an isolated system, in which the energy U and volume remain unchanged, the entropy cannot change [22]. This is the reason why "the question of the physical foundations of the monotonic increase in entropy still … remains open" [23]. The interpretation of entropy by L. Boltzmann as a measure of the thermodynamic probability of a state, which gives the Universe an insignificant chance for "survival" [24], is not a way out either. The fact that thermal equilibrium did not occur in it for at least 13.75 billion years, allotted to it by the "Standard Model", testifies to the inconsistency of this principle with the essence of the matter. Therefore, the principle of entropy increase cannot serve as a criterion for the evolution of the Universe.

The introduction by energodynamics of the missing parameters of spatial inhomogeneity, which are the distribution moments of any energy carriers $Z_i = \Theta_i r_i$ and thermodynamic forces $X_i = \nabla \psi_i$, which directly reflect the evolution (dX_i, $dZ_i > 0$) or involution (dX_i, $dZ_i < 0$) of each of the degrees of freedom inherent in the system, make the use of entropy in this role generally redundant. Non-equilibrium parameters, along with their clarity, supply much more detailed, and not only qualitative, but also quantitative information about the behavior of a polyvariant system than entropy, which describes only the behavior of the system. These parameters make obvious the simultaneous flow of the process of evolution of some, and involution of other degrees of freedom or parts of the system. Thanks to this, the energodynamic

analysis of the problems of evolution and involution makes it possible to solve several mysteries of the Universe without resorting to unverifiable hypotheses and postulates. This once again emphasizes the limitations of thermodynamics, the laws of which are based on the behavior of material forms of energy and do not consider the processes opposite to them, not only in its field forms, but also in the same material forms. Particularly egregious, according to I. Prigogine, is the conflict between thermodynamics and the evolution of biological systems, forcing us to look for its solution outside the framework of both theories [25].

The occurrence in living organisms, along with the relaxation of opposite processes, is shown by the phenomenon of "active transport" in biological membranes (the transfer of substances into them in the direction of increasing their concentration and many "conjugated" chemical reactions (occurring in the direction of increasing their affinity). Spontaneous occurrence of such processes, "opposite" to relaxation ones, excludes the possibility of postulating the laws of thermodynamics that set up their one-sided direction, and requires its thorough correction, considering the specifics of real (non-static) processes [26].

3.7. Circulation of role and material forms of the matter of the Universe

Finding the field form of the law of gravity and the driving force of the process of wave energy exchange was the missing link, which made it possible to verify the spontaneous nature of the processes of local evolution and involution of the Universe. For the processes of mutual transformation of the field and material forms of its matter, such a driving force is the potential difference of the ether $\psi_o = c^2$ and any k-th substance $\psi_g = \upsilon^2$, since the velocity of propagation of perturbations in the substance $\upsilon < c$ and is equal to c/n_k, where n_k is its refractive index. Therefore, the process of "condensation" of the ether is carried out spontaneously and continuously in the Universe, obeying the uniform energodynamic laws of transformation of any form of energy. One of the manifestations of the occurrence of such processes in real time is the "excessive" energy release, found in several processes of low-current electrolysis of water [27], in the reactions of "cold nuclear fusion" [28]; in many "over-unit" devices [29], etc. At present, there are so many examples of such "over-unit" devices that, in the words of Academician V. A. Trapeznikov, "it is impossible to deny them without drawing to destroy science." However, since the processes in the Universe are extremely slow on the scale of human life, these effects are found only in some catalytic or enzymatic reactions.

To understand the "mechanism" of the process of transformation of ether into matter, let us imagine that at some point of the ether with a density $\rho_o = \rho_o$ (**r**, t) at least a slight local density has spontaneously arisen. By the law of gravity (11), this causes an "inflow" of ether from the vicinity of this compaction, which and further compaction of this area, which, due to the invariance of the sign $\nabla \rho_o$, will continue after the transition of the ether into the substance of the flesh until the singularity $\rho = \infty$ appears in it and the vanishing of $\nabla \rho / \rho$. However, this process of complication of the structure of matter can end even before the appearance of a singularity if nuclear reactions begin in the matter with the release of heat and an increase in internal pressure. When the internal stresses caused by this exceed the weakening forces of attraction, the stability of the celestial body will be violated and a relatively fast phase of its destruction will begin, now called the "supernova explosion" and the later "big gap" of the structural elements of these celestial bodies with the return of matter to its original state. In this circulation of the matter of the Universe there is a place for the so-called "black holes" (BH). They can arise at a certain stage of the process of compaction of the galaxy core, when, due to the accretion of stellar matter and ether into the black hole, the gravitational forces reach a value that does not allow matter and radiation to leave it. However, the size of this BH is many orders of magnitude greater than the radius of the Schwarzschild sphere $R_g = 2GM/c^2$, where M is its mass, G is the gravitational constant, and, apparently, has clearly defined boundaries, called the "accretion belt". The reason is that the forces of gravitation in the ether, decided by law (11), are not the "weakest" of the known types of interaction, but, on the contrary, the "strongest", since the gravitational potential ψ_g, which plays the role of a proportionality coefficient in it, in any less substance than ether. Judging by the stability of the atoms formed from the waves of the ether, the size of these forces is not inferior to the hypothetical nuclear forces, which are 10^{38} times greater than the Newtonian forces. So, with an equal BH mass, its radius is 10^{19} times greater than the Schwarzschild one. This sphere stays invisible until the forces of internal pressure exceed the forces of gravity in its weakest point - on the axis of rotation of the galaxy. Then there is an ejection of "jets" from it in the form of stellar matter (Fig. 7). As the black hole becomes denser, the area of matter ejection expands and turns into a zone of increased luminosity (the luminous "core" of the galaxy). Thus, BHs from the "burial grounds" of stars that have exhausted their energy, in the energodynamic theory, turn into their "factories" [30].

The sequence of evolutionary and involutionary processes in the Universe described here can, for brevity, be depicted as a chain of events: inhomogeneous immobile ether → occurrence of oscillations → wave compaction → ether condensation and nucleosynthesis → formation of atoms, molecules, gaseous, liquid and solid substances → formation of small and large celestial bodies → the occurrence of nuclear reactions in them → an increase in internal pressure and a weakening of the forces of gravity in them as they become denser ($\nabla \rho / \rho < 0$) → ejection of "jets" from "black holes" →

"black hole explosion" and the appearance of a "supernova" → subsequent destruction mega, macro and microstructures of celestial bodies → return of matter to its original state.

The justification given above for such local cycles of matter in the Universe and their consistency with the latest astrophysical data allowed the Israel Association of Inventors to recognize their existence as a discovery [31]. It cuts many absurdities of the "Standard Model" and does not contradict the echoes of the knowledge of our brothers in mind that have come down to us about the possibility of the existence of the Universe not limited by time and space, bypassing the state of equilibrium.

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