

Perpetual movement of the universe

Abstract

The article substantiates the concept of the dynamic Universe, according to which the circulation of the field (continuum) and corpuscular phases of matter with their inherent forms of energy is carried out in it. 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” energy into “gravodynamic” (oscillatory) with the formation of baryonic (structured) matter in the process of nucleosynthesis, the appearance in its thermonuclear reactions and its permanent compaction up to the singularity in separate regions of the Universe. The second stage includes the “explosion” of supernovae, their “big gap” and the return of matter to its original state. In this circuit, gravity plays the role of a “perpetual motion machine” that allows the Universe to function in time and space indefinitely, bypassing the state of equilibrium. The data of astronomical observations confirming the proposed concept are presented.

Keywords: perpetual motion, matter, field environment, gravitational, gravodynamic energy, gravitation, repulsion, circulation of matter, energy, evolution, involution

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Introduction

The inconsistency of the theory of “thermal death of the Universe” by R. Clausius has long become obvious.¹ However, attempts have still not been abandoned to impose a ban on its operation indefinitely, bypassing the state of equilibrium. The fantasies of supporters of the “Standard Model” of the Universe, who adhere to the concept of its birth as a result of the “Big Bang”, include the recognition of the possibility of its emergence “out of nothing” and the assertion that “the energy of the closed Universe is equal to zero”, since “the gravitational energy of the interaction of parts is negative and exactly compensates positive energy of the sum of all parts of matter.”^{2,3} This kind of “progress” of postclassical science has only the advantage that it reliably provides work for the community of researchers who are forced to look for ways to resolve the numerous paradoxes and paralogs associated with the general theory of relativity (GR) and the cosmology based on it. “The vitality of ideas is determined by the number of those who feed on them,” as V. Pauli ironically noted on this occasion.⁴ It came to the recognition that “modern physics is a complete swindle.”⁵

Meanwhile, G. Galileo, the founder of mechanics, in his experiments on the free fall of bodies and their rolling or sliding off an inclined plane in the Earth’s gravitational field, discovered the interconversion of “dead” and “live” forces, or, in modern terms, the transformation of the external potential energy of bodies into E' into the kinetic energy of translational E^w and rotational E^ω motion, as well as their dissipation with transformation into internal energy of disordered (thermal) motion U . Subsequently, this served as the basis for replacing the concept of “living force” G. Leibniz Mv^2 with the term “energy” (T. Jung, 1807) and the establishment of the law of conservation of the total energy of the system E : in an isolated system.

$$\dot{A}_{iz} = \dot{A}^r + \dot{A}^w + \dot{A}^\omega + U = const, \quad (1)$$

In which all terms on the right side are purely positive and can be converted into each other in equivalent amounts.⁶

Such a glaring contradiction between classical and postclassical physics in relation to key concepts forces true natural scientists, not

burdened with personal career considerations, to start “from scratch” and build a new (unified) physics on their own conceptual and conceptual basis that does not allow paralogs.

The purpose of this article is to show that the Universe as a whole, as the whole set of interacting and mutually moving material objects, really has the properties of a miraculous “perpetual motion machine”, without violating any prohibitions of thermodynamics, if from the very beginning we proceed from the understanding of matter as “everything that exists” (objectively existing) and adhere to dialectical principles that dictate the opposite direction of real (non-equilibrium) processes in it.

Opposite direction of processes in the universe

Currently, a genuine cosmological revolution is taking place, characterized by an abrupt growth of new knowledge about the Universe as a whole. This knowledge radically changes our understanding of the processes taking place in it.

One of these fundamental discoveries was the discovery at the turn of the 20th and 21st centuries that only a small part of the mass of the entire Universe (no more than 5%) is visible (observable), and most of it does not participate in electromagnetic interactions and therefore is “hidden” (dark).⁷ This is tantamount to admitting that of the four types of long-range interactions known to science, only the gravitational one remains for the hidden mass, so that it should be considered the main form of energy of the Universe. The transformation of gravitational energy into other forms, discovered in the above-mentioned experiments of Galileo, is the basis of all evolutionary processes occurring in it. However, to prove this, it is necessary to find the “primary” material carrier of gravity, which has an all-penetrating ability and is capable of transforming into any other forms of matter in the Universe. Here, the knowledge that has come down to us from the depths of millennia about the existence of invisible and intangible “subtle” matter, which initially filled all the space provided to it, turns out to be useful, from which “gross” matter was formed by compaction, which has boundaries and is called substance. In ancient India, this medium was called “Akasha”, in Europe of the Middle

Ages - ether, and in post-classical physics - “hidden mass”, “physical” (“cosmic”) vacuum”, “dark matter”, “dark energy”, etc. We will refer to it as “field environment” to avoid identifying it with any of their models, or more briefly “prematter” to emphasize its existence before all known forms of matter emerged from it. Its main feature of this environment is the absence of boundaries, i.e., the ability to occupy the entire space without any voids. This property means that it is present everywhere from the very beginning, thus becoming an indispensable component of any material system. This medium is incompressible, since, due to its all-permeability, a decrease in the volume V occupied by it does not lead to an increase in its density $\rho_i = \dot{M}_i / dV_i$ due to a proportional change in its mass M_i . However, this does not exclude the possibility of its compaction by the flow of mass dM_i from one region of space to another, which is confirmed by the formation of small and large celestial bodies from it.

According to modern data, the density of the field medium ρ_0 is $\sim 10^{-27} \text{ g cm}^{-3}$, which is tens of orders of magnitude less than the density of white dwarf stars. This indicates the inhomogeneity of the matter of the Universe, which is incompatible with the prevailing ideas about the homogeneity and isotropy of the space filled with matter as a basis for proving the laws of conservation of energy and momentum in it.⁸ Moreover, it can be proved that no processes at all are possible in a homogeneous medium.

Indeed, any extensive parameter of the k -th substance of the system, including its external E_k or internal energy U_k and the quantitative measure of their material carrier Θ_k (mass M_k , number of moles N_k , entropy S_k , electric charge Θ_k , impulse P_k , its momentum L_k , etc.) etc.) Can be represented by an integral of its local density $\rho_k = d\Theta_k / dV$ and mean density $\bar{\rho}_k = \Theta_k / V$ by an expression like $\Theta_k = \int \rho_k dV = \int dV$. It immediately follows from this that

$$\int [(d(\rho_k -) / dt) dV] \equiv 0 \quad (2)$$

It is easy to see that under the conditions of any process $d(\rho_k -) / dt \neq 0$, expression (2) vanishes only if the sign of $d(\rho_k -) / dt$ is opposite at least in a number of elements of its volume dV , i.e. when the processes in the system proceed in the opposite direction. This provision, which we called the “principle of opposite directions of processes”, can serve as a mathematical expression of the dialectical law of unity and struggle of opposites.⁹ According to him, real processes occur only in inhomogeneous (internally non-equilibrium) systems. This excludes the simultaneous emergence of the entire Universe from some single “singularity”, which is embedded in its standard cosmological model.¹⁰

The impossibility of the occurrence of processes in a homogeneous system also follows from the “zero law of classical thermodynamics” (“the principle of self-inviolability of equilibrium”, according to which a system that has reached a state of internal equilibrium (homogeneity) cannot be removed from this state without outside influence.¹¹ This forces us to consider The Universe as an inhomogeneous (internally non-equilibrium) system in which the processes of evolution and involution (degradation) occur simultaneously.¹²

Wave formation in the field medium and its energy

An immediate consequence of the inhomogeneity of the Universe is the inevitability of oscillations at least in some part of the field medium. Indeed, in an inhomogeneous system, the density ρ_0 becomes a function of spatial coordinates (radius vector r) and time t , i.e., $\rho_i = \rho_i(r, t)$, so that its total time derivative $d\rho_i / dt$ includes the local $(\partial \rho_i / \partial t)_r$ and convective $(\partial \rho_i / \partial r) (dr / dt) = (v_i \cdot \nabla) \rho_i$

component. This allows us to give this derivative in this incompressible medium ($d\rho_i / dt = 0$) the form of a “kinematic” wave equation:¹³

$$v_i^{-1} (\partial \rho_i / \partial t) + (\partial \rho_i / \partial r) = 0 \quad (3)$$

This equation describes a wave propagating from a source, which is illustrated in Figure 1. According to it, a traveling wave is accompanied by the transfer of a certain amount M of the hidden mass from a position with a radius vector r' to a position r'' . The average speed \bar{v} of this transfer is determined by the displacement ratio $r'' - r'$ of the center of its mass M to the period v^{-1} of the wave with frequency ν , and its modulus v is equal to the propagation velocity of disturbances in the given medium. For empty space, it is obviously equal to the speed of light in vacuum c , so that the “living force” of G. Leibniz Mv^2 , which in this case is the energy of vibrations of the hidden mass E_0 , is equal to:

$$\hat{A}_i = \dot{M}_i \bar{v}^2. \quad (4)$$

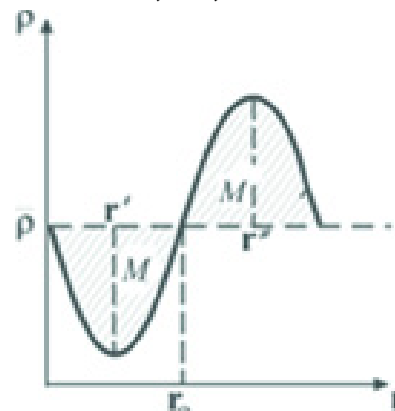


Figure 1 Wave formation.

It was to this result that H. Schramm (1871) arrived before A. Einstein; N. Umov (1873); J. Thomson (1881); O. Heaviside (1890), A. Poincare (1898); Hasenorl (1904), estimating the energy of the ether.¹⁴

A. Einstein in 1905 came to the same conclusion, taking as a basis the relativistic expression for the mass M_{rel} and limiting himself to the first two terms of its expansion into the binomial series.¹⁵ At the same time, he extended the expression (4) to all types of matter and interpreted it as “the principle of equivalence of the mass M_0 and energy E_0 of rest during their mutual transformations.” However, such an interpretation goes beyond (4), since the concept of “transformation” means a decrease in one thing and an increase in another. Expression (4) cannot be interpreted as an interchangeability of energy E_0 and mass M_0 , since mass is only one of the arguments of energy as a function of the state of the system. Moreover, since the propagation velocity of perturbations in the k -th substance v_k is less than the speed of light in the “emptiness” c by the refractive index n_k , the “live force” in them is $E_k = M_k v_k^2 = M_k c^2 / n_k^2$ and even at $n_k = \text{const}$ it is only proportional to mass M_k . Therefore, it is advisable to call relation (4) more modestly “the principle of proportionality of mass and energy.”¹⁶

Since there are still no other fields inherent in matter (including electromagnetic ones) in the hidden mass, the waves described by equation (3) are gravitational. They also exist in any k -th substance, the energy of which is the gravitational potential $\psi_k = \partial E_k / \partial M_k = v_k^2 = c^2 / n_k^2$ and depends on its nature (including its local density ρ_k and refractive index n_k). In other words, $\psi_k = \psi_k(r)$, i.e., the field of the gravitational potential is also inhomogeneous.¹⁶

One of the important consequences of this heterogeneity is the possibility of transformation of the “hidden” mass into the “ordinary” (baryonic) mass in miraculous energy converters created by nature itself. The inhomogeneous environment is not subject to the ban on the creation of a “perpetual” motion machine imposed by the 2nd law of thermodynamics [11]. On the contrary, the lowering of the potential of the converted form of energy in this process from $\psi_g = c^2$ to $\psi_k = c^2/n_k^2$ points to the spontaneous character of this process. This justifies the introduction of the concept of its relative efficiency η_k as the ratio of the specific energy of the k -th substance $\varepsilon_k = c^2/n_k^2$, obtained in this process, to the specific energy of the source $\varepsilon_o = c^2$:

$$\eta_k = \varepsilon_k / \varepsilon_o = 1/n_k^2. \quad (5)$$

This efficiency is always less than unity due to the presence of energy losses $\varepsilon_o - \varepsilon_k$, due to the accompanying α , β and γ radiation, which brings together the principles of operation of “man-made” and “non-man-made” energy converters.

Another consequence of principle (4) is the prediction of the achievability in field media of extremely high propagation velocities of perturbations. Indeed, if expression (4) is written in terms of the energy density of the hidden mass

$$\varepsilon_g = dE / dV = \rho^2, \quad (6)$$

Then the speed of light can be found from the expression:

$$\tilde{n}^2 = d\varepsilon_g / d\rho = (d\varepsilon / dt)_k / (d\rho / dt). \quad (7)$$

Since in field media $d\rho/dt \rightarrow 0$ due to their incompressibility, the speed of light in them is higher than in compressible ones. However, this does not mean that its value $c \approx 3 \cdot 10^8 \text{ m s}^{-1}$, found in the regions of the Universe accessible to observation, does not depend on its density. On the contrary, as follows from Fig. 1, it is equal to the average velocity of density oscillations in the wave v and therefore is not limiting. This excludes the possibility of postulating its immutability in the Universe as a whole.

Another equally important consequence of (4) is the inadmissibility of assigning a negative sign to the potential energy. Indeed, if we take into account the vector nature of the velocity $v = dr/dt$, then from (4) at $M = \text{const}$, taking into account the Newtonian definition of the force $d\mathbf{P} / dt = \mathbf{F}$, we have:

$$\dot{v}^2 = 2d\mathbf{P} = d(M^2/2) + F d\mathbf{r} = dE^v + dE^r, \quad (8)$$

Where $E^v = M^2/2$, $E^r = \int F_i \cdot d\mathbf{r}_i$ are the kinetic and potential components of the energy (“live force”) of an isolated system, for which $E = U = Mv^2$. The purely positive sign of the components of internal energy U forces us to reconsider the conditions for calibrating Newton’s law $F_g = GmM/R^2$, which expresses the modulus of the gravitational force F_g through the masses of the “trial” m and “field-forming” M bodies, and the distance R between their centers. In view of the divergence of this law at $R = 0$, the distance $R = \infty$ is taken as the zero of the reference of gravitational forces, which leads to negative values of the gravitational energy. Meanwhile, in real conditions, when the “field-forming” and “test” bodies have finite dimensions, the work done by the gravitational field when they approach each other is performed only when they approach to a distance $R = R_o$ equal to the sum of their radii. This configuration of contiguous bodies should be taken as the origin of the gravitational potential ψ_g , since further convergence of solid bodies with the performance of work is impossible. With this calibration, the gravitational energy of the considered pair of bodies M and m is determined by the expression:

$$E_g = GmM(1/R_o - 1/R), \quad (9)$$

in which the starting point for the energy E_g is the state $R = R_o$ with the minimum gravitational energy $E_g = 0$. In this case, there is no divergence of either the forces F , or the energy E_g , or the potential $\psi_g = E_g/m$, or the acceleration g as $R \rightarrow R_o$.¹⁴ From the standpoint of energy dynamics, such a calibration is the only acceptable one, since for the Universe as an isolated system, the total energy E is equal to the “live force” Mv^2 , which, in principle, cannot be a negative value.

Another fundamental provision concerns the nature of the “living force” of the field environment $E_o = M_o v^2$. Since the only form of energy possessed by this medium is gravitational, the energy of its vibrations $M_o c^2$ is inherently *gravodynamic*. According to (8), when the oscillatory motion is attenuated, this energy is completely converted into potential E^r , which is gravitational in nature. If for the gravodynamic energy its material carrier (briefly, the energy carrier) is known (for the disordered and ordered form of motion, it is the amount of movement $P_o = M_o v$ and impulse $\mathbf{P}_o = M_o \mathbf{v}$), then for the gravipotential energy it is unknown. This poses the problem of finding an energy carrier for potential forms of energy, without which the description of the state of the Universe and the processes occurring in it will be incomplete.

Energodynamic equation of the universe

Consider the field of any i -th form of energy, due to the uneven distribution in space of the energy carrier corresponding to it $\rho_i(\mathbf{r}, t) = d\Theta_i/dV$ as a function of the radius vector of the field point \mathbf{r} and time t (Figure 2). It follows from it that when the distribution Θ_i deviates from uniform density $\bar{\rho}_i$, some of its quantity Θ_i^* is transferred from one part of the system to another in the direction indicated by the dotted arrow. Such a “redistribution” of the extensive value Θ_i causes a shift of its center from the initial position $R_i = \Theta_i^{-1} \int r dV$, to the current $R_i = \Theta_i^{-1} \int r_i dV$, which leads to the emergence of a certain “distribution moment” $Z_i = \Theta_i \Delta R_i$ with its shoulder

$$\Delta R_i = \mathbf{R}_i - \mathbf{R}_{i0} = \int (\mathbf{r} - \mathbf{r}_0) \rho_i dV \quad (11)$$

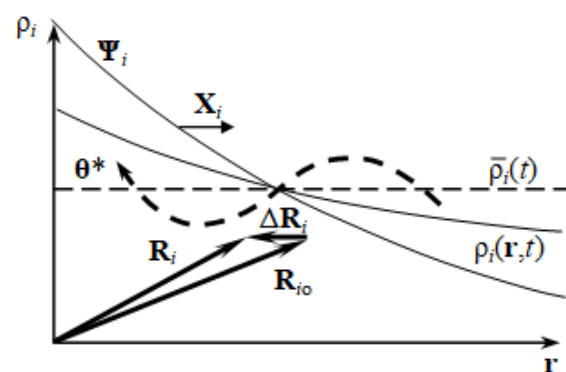


Figure 2 To the formation of a vector polarization.

The meaning of the moment Z_i will become clearer if we pay attention to its similarity with the electric or magnetic polarization vectors. It is also easy to see that the derivatives with respect to time t of these moments Z_i determine the so-called energy carrier flows J_i in the theory of stationary irreversible processes (TIP):¹⁷

$$J_i = dZ_i / dt = \Theta_i dR_i / dt = I_{Vi} \quad (12)$$

In the case when the mass of the k -th substance M_k is the energy carrier, these flows have the meaning of their impulse $\mathbf{P}_k = M_k \mathbf{v}_k$. The scalar analogue of this impulse $P_k = M_k v_k$ is known as amount of movement. For the thermal form of energy, it is advisable to call it

a *thermoimpulse*, since it is an ordinary mechanical impulse that has lost its vector nature due to the chaotic nature of this movement. This corresponds to the representation of the internal thermal energy U_q as a “living force” Mv^2 of disordered oscillatory motion, expressed as the product of the thermo- impulse $\Theta = P_q = Mv$ and its average velocity v . Thus, the arguments of the i -th form of the “partial” energy E_i ($i=1, 2, \dots, I$) are not only the quantities of motion of this kind $\Theta_i = P_i$, but also their “displacement vectors” from the equilibrium position ΔR_i . If we take $R_{i0} = 0$ as the reference point, then the “partial” energy $E_i = E_i(\Theta_i, R_i)$ will become a function of the variables Θ_i and R_i , and the energy of the system as a whole $E = \sum_i E_i(\Theta_i, R_i)$ will become a function of two groups of variables Θ_i and R_i . In this case, its total differential can be represented as an identity:⁸

$$dE \equiv \sum_i \Psi_i d\Theta_i + \sum_i F_i dR_i, \quad (13)$$

where $\Psi_i \equiv (\partial E_i / \partial \Theta_i)$ are the averaged values of the potential of the i -th form of energy Ψ_i (its absolute temperature T and pressure p , chemical μ , electric ϕ , gravitational ψ_g and other potentials); $F_i \equiv (\partial E_i / \partial R_i)$ – forces in their general physical understanding.

From here it directly follows that any (including gravitational) forces F_i are determined by the gradients of the corresponding form of energy E_i , and any force fields are generated by the uneven distribution of its energy carrier Θ_i in space. This puts an end to the notion of “fields” as material entities and appear as areas of space in which any F_i forces are found.

To reveal the connection of this work with the processes of interconversion of energy (E^v , E^w , E^ω and E^r) into each other, we multiply and divide this expression by Θ_i :

$$dW_i = (F_i / \Theta_i) \cdot (\Theta_i dR_i) = X_i \cdot dZ_i, \quad (14)$$

where $X_i = F_i / \Theta_i$ is the so-called thermodynamic force, which has the meaning of the specific value of the force F_i ; $dZ_i = \Theta_i dR_i$ is the change in the “moment of distribution” of the energy carrier Θ_i when the system deviates from internal equilibrium, which has the meaning of the polarization vector of the i -th degree of freedom of the system.

It also follows from (14) that the process of system polarization is associated with its deviation from the equilibrium state and the emergence of internal processes of energy conversion from any of its i -th form (for example, gravitational) to j -th (for example, kinetic), power which is equal to $dW_i / dt = F_i \cdot dR_i / dt = F_i \cdot v_i = X_i \cdot J_i$. Velocity v_i can be decomposed into independent translational w_i and rotational $\omega_i \times R_i$ (with angular velocity ω_i and instantaneous radius R_i). Then the power of non-static processes in the system under consideration is expressed by the equation

$$dU / dt = \sum_i \Psi_i d\Theta_i / dt + \sum_i F_i \cdot w_i + \sum_i \mathcal{M}_i \cdot \dot{\omega}_i, \quad (W) \quad (15)$$

where $\mathcal{M}_i = F_i \times R_i$ is the torque of forces F_i .

A change in the momentum, expressed by the value Θ_i , is possible as a consequence of their consumption $J_i = - \int \nabla \cdot j_i dV$ through the boundaries of the system, and due to the presence of internal sources of this quantity $\int \sigma_i dV$ with a density $\sigma_i = d\Theta_i / dV$.

For isolated systems such as the Universe as a whole, it is necessary to switch to the integral form of the law of conservation of energy (15) due to the opposite direction of processes in its individual regions, components or their phases. To do this, we use the concept of density $j_i = \rho_i w_i$ of the flow $J_i = \int j_i dV$ of the energy carrier Θ_i and take into account that in an isolated system the change in Θ_i is due solely to the presence of their sources. $\int \sigma_i dV$ with density σ_i . Then the law of conservation of energy of the Universe will take the form:

$$\sum_i \int \Psi_i \sigma_i dV + \sum_i \int X_i \cdot j_i dV + \sum_i \int \mathcal{M}_i \cdot \dot{\omega}_i dV = 0. \quad (16)$$

Here $X_i = \nabla \Psi_i$, μ_i , ω_i are local values of thermodynamic forces X_i , moments \mathcal{M}_i and angular velocities.

If we take into account that in the general case the i -th form of energy ($i=1, 2, \dots, I$) is available for all k -th components of the system ($k=1, 2, \dots, K$) in any of its j -th state of aggregation ($j=1, 2, \dots, J$), then the total number of degrees of freedom of the Universe described by equation (16) becomes finite and equals $I=3KL$. The main advantage of this “universe equation” over the Einstein-Hilbert-Friedman model [10] is that it does not contain any concepts that are not known to classical physics, does not require any hypotheses and postulates, does not contradict the law of conservation of energy and does not impose on the Universe the simultaneous occurrence of the same processes in all its areas (“multiverses”). On the contrary, it follows from it that under normal conditions, when the sources and sinks of various forms of energy of the Universe mutually compensate each other, i.e., when $\sum_i \int \Psi_i \sigma_i dV = 0$, then processes like evolutions simultaneously occur in it ($X_i \cdot J_i > 0$) and involution (degradation) $X_j \cdot J_j < 0$,¹⁸ since

$$\sum_i \int X_i \cdot j_i dV = \sum_i \int \nabla \cdot \Theta_i \cdot J_i = 0. \quad (17)$$

This does not leave room for the concept of the birth of the Universe through its “Big Bang”.

Gravity as the “fuel of the universe”

Let us now show that gravity 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. For this, we apply the operator ∇ to both parts of equality (6) and take into account that $\nabla \psi_g = \rho g$. Then we will directly come to the short-range (field) form of the law of gravity, which expresses the dependence of the free acceleration g on the relative gradient $\nabla \rho / \rho$ at a given point of the gravitational field:¹⁹

$$g(r) = \psi_g(r) \nabla \rho / \rho. \quad (18)$$

According to this expression, the direction of action of the gravitational forces F_g at a given point in space, as well as the strength of the gravitational field $H_g = \rho g$, i.e., coincides in direction with the density gradient of the hidden mass $\nabla \rho$ in it. This means that in the area where $\rho_k > \bar{\rho}_k$, there are “pushing” forces to the area of increased density, tending to increase the resulting field inhomogeneity, and where $\rho_k < \bar{\rho}_k$, on the contrary, to reduce it. In other words, gravitational forces are both attractive and repulsive, depending on the distribution of mass and the position of the observer. In this respect, law (18) is not a generalization of Newton’s law but is something fundamentally new. According to him, gravity is not an innate, but an emergent property acquired by matter due to its non-uniform distribution in space.

Another most important consequence of the law (16) is the existence of “super gravity”, which is not inferior to “strong interaction. This makes it superfluous to postulate the existence of a special class of “nuclear” forces of an unknown nature, as well as mysterious “gluons” as carriers of the “strong interaction”, which opens a direct path to the creation of the “unified field” theory.²⁰

It is no less important that the energy $E_g = M_o c^2$, released during the condensation of a unit amount of hidden mass M_o , is equal to 931.5 MeV/a.m.u., while the binding energy of nucleons in the nucleus $E_c = c^2 \Delta M_o$ is almost two orders of magnitude smaller. The latter means that it is the gravidynamic energy consumed in the process of nucleosynthesis that is also the main “fuel” of stars.²¹ It is no coincidence that the temperature on the surface of the sun, where this

synthesis mainly takes place, exceeds that in its core. Since such a phase transition is accompanied by a decrease in the gravitational potential from $\psi_g = c^2$ to c^2/n_k^2 , it occurs spontaneously and continuously in the Universe. Due to this, the process of latent mass condensation can serve as a tangible source of energy even when it proceeds extremely slowly. This is, apparently, the reason for the release of “excessive” power or heat in the so-called “super unit” energy converters (with an efficiency higher than unity), which are erroneously referred to as “perpetual motion machines of the 1st kind.”²²

Gravity as an engine of evolutionary processes

The evolution of the material part of the Universe (appearance of new properties in matter, the synthesis of atoms and their compounds, the birth of small and large celestial bodies and the formation of galaxies) is impossible without performing some work $W_i = \mathbf{F}_i \cdot d\mathbf{R}_i$ on the object, which is performed due to a decrease in the gravitational energy of the hidden mass. Consequently, the dialectic of the Universe assumes the existence of an antipode of matter in it, which changes its state in the opposite way in this process. Such an antipode, as shown above, is the field medium, currently called the “physical field”.

Let us imagine that at some point of the field medium with a density $\rho_o = \rho_o(\mathbf{r}, t)$ at least a slight local mass compaction ($\partial\rho_o/\partial t > 0$), has spontaneously arisen. Then, in accordance with the law of gravity (16), an influx of the field medium from outside arises to this point. This compaction process continues as long as the sign of $\nabla\rho < 0$ remains unchanged. When the density of the medium reaches the threshold of condensation, the process of “condensation” occurs in it, accompanied by the formation of condensed matter with certain boundaries and structure.

To reveal the specifics of the processes of structure formation, we use the mass conservation law $M = \int \rho dV = \tilde{n} V = \text{const}$. Dividing the volume V into two parts V' and V'' with density respectively $\rho' > \tilde{n}$ and $\rho'' < \tilde{n}$, based on the law of conservation of mass, we have:

$$\frac{d}{dt} \int_{V'} \rho' dV + \frac{d}{dt} \int_{V''} \rho'' dV = 0. \quad (19)$$

In accordance with (19), the processes of compaction in one part of the Universe $d(\rho' - \tilde{n})/dt > 0$ are inevitably accompanied by processes of decompression of others $d(\rho'' - \tilde{n})/dt < 0$ only visible matter, but also invisible (non-baryonic) matter. If $V'' \approx V'$, then on average $|\rho' - \tilde{n}| \approx |\rho'' - \tilde{n}|$, i.e. as a result of such a redistribution, a sinusoidal wave is formed, shown in Figure 1. However, if $|\rho'' - \tilde{n}| \ll |\rho' - \tilde{n}|$ (in hydrodynamics, this is called “shallow depth”), a single spherically symmetrical, structurally stable wave of compaction (“elevation”), called a soliton (Figure 3). Running sea waves of this type are called tsunamis. Such an “elevation wave” is formed due to the “flow” of the medium from a region that is much larger than the wavelength. In an isotropic field medium, such a structure looks like a spherical compaction (the nucleus of the future atom), which oscillates (pulsates) under conditions $\rho' - \tilde{n} > 0$, remaining structurally stable. With distance from the center of such a soliton, the value of $\nabla\rho/\rho$ and the amplitude of the waves decrease, so that their shape approaches harmonic. Such waves are located at a distance from the center of the nucleus, a multiple of the wavelength, and are similar to spherical electron clouds. This is precisely the model of the Schrödinger atom,²³ in which the number of such spherical shell waves increases 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.²⁴ This allows revealing the physical nature of the concept of “electric charge” and for the first time defining it as a part of the mass of an atom, located in these shells and emitting harmonic waves with a

spectrum different from the background radiation of the field medium. Such a model ensures the constancy of the ratio of the mass of these shells to its “charge”, and the appearance of closed waves running along the shell explains such a property as “spin”.²⁶ This (wave) concept of the structure of matter was most briefly expressed by Jeans, who stated that “in the world there are waves and only waves: closed waves, which we call matter, and open waves, which we call radiation or light.”²⁵

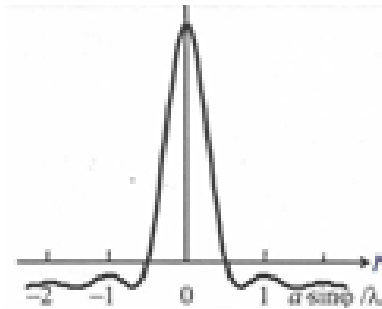


Figure 3 Standing soliton.

Testable theory predictions

The energodynamic theory of gravity is based on firmly established theoretical positions and is free from any hypotheses and postulates. Therefore, it is not surprising that she finds confirmation in many of her predictions.

Non-Newtonian character of the rotational curves of galaxies

One of these predictions concerns the nature of the rotation curves (Figure 4), which, according to Newtonian mechanics of solids, should have the form of a dotted curve A. However, observations of numerous rotating galaxies have shown that the actual nature of the rotation curves is closer to the red curve B. The reasons for this discrepancy are not difficult find, if we take into account in the law of gravity (18), the spatial inhomogeneity of the distribution of matter in spiral galaxies. In this case, the equality of the forces of gravity $\tilde{g} = \psi_g \nabla\rho/\rho = -g^2 \nabla\rho/\rho$ and the forces of centrifugal acceleration $\tilde{g}_y = v^2/r$ leads to the relationship:

$$(\nabla\rho/\rho)\tilde{n} = -(v/r)^2. \quad (20)$$

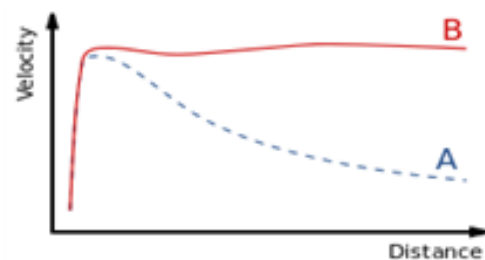


Figure 4 Rotation curves of galaxies.

According to this expression, the rotation speed of the peripheral layers of galaxies v/c can remain constant if the relative density gradient of matter in them $\nabla\rho/\rho$ decreases towards the periphery in inverse proportion to its radius.

Wave formation in outer space

According to the energy-dynamic theory of gravity, ordinary acoustic (longitudinal) waves inevitably arise in a space with an

inhomogeneous density. The largest waves of this kind arise during collisions of galaxies and are detected at distances of more than 250 million light years. By the enhanced glow in the area of the shock wave front (Figure 5). Apparently, they were discovered by the LIGO collaboration, since the principle of operation of their interferometer was based precisely on the short-term approach of freely suspended reflectors removed at a considerable distance (i.e., designed for long wavelengths). In any case, the connection of these waves with distortions of the space-time metric does not follow explicitly from the known equations of the Universe.



Figure 5 Shock waves from galaxy mergers.

The existence of “gravitational repulsion”

In regions of the Universe with a low density of the latent mass (from $\sim 10^{-27}$ to $\sim 10^{-34}$ g cm $^{-3}$) $\rho < \bar{n}$, and it is clearly not enough for the condensation process to occur. In this case, according to Figure 6, gravitational forces act in the direction of “smoothing” the wave, i.e., increasing its length λ . This means that the region of low density tends to expand, causing the peripheral regions of galaxies and metagalaxies to move away from each other. Since the “redshift” prevails in this case, this removal is perceived as the “expansion of the Universe”. In fact, the volume of the Universe as a whole is infinite, and it has no boundaries. Only the boundaries of galaxies and metagalaxies are removed as they become denser, although their centers remain motionless. The latter is due to the fact that $\nabla\rho = 0$ in them, and there are no repulsive forces in them. As galaxies compact and $\nabla\rho$ grows, this phenomenon intensifies, which is perceived as an “accelerated expansion” of the Universe. This removal of boundaries leads to the formation of “voids” between galaxies - cosmic voids of huge dimensions (over a billion light years), free from celestial bodies. One of the largest of them - the Bootes Void - is shown in the NASA photograph (Figure 3).

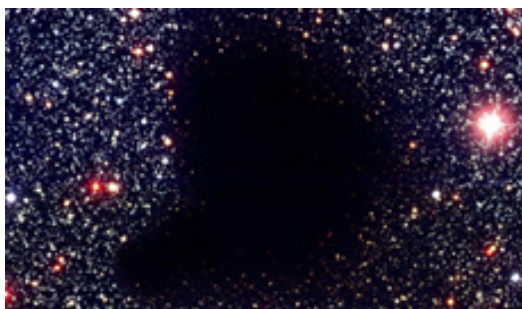


Figure 6 Void of Bootes.

The existence of gravitational equilibrium

Astronomers often observe cases when stars, which, due to Newton’s law of gravity, should have been grouped in the center of the galaxy, on the contrary, are located at a considerable distance from it and form ring structures, as shown in Figure 7. It looks as if there are gravitational “repulsive” forces between them. However,

such structures turn out to be very stable and show no tendency either to move away or to approach each other. The solution follows from the existence of a stable gravitational equilibrium corresponding to the condition $\nabla\rho = 0$. Such conditions are typical for wave structures in the region of increased density ($\rho > \bar{n}$), when gravitational forces are aimed at reducing the wavelength and increasing its amplitude (Figure 1). In this case, gravitational forces are absent in the antinode of the compression wave, which determines the stable location of star clusters at distances that are multiples of the wavelength. This also implies the difference in the sign of $\nabla\rho$ on both sides of the antinode, i.e., the existence of “gravitational funnels” that delimit the areas of attraction of “field-forming” bodies.



Figure 7 Concentric arrangement of star clusters.

The flow of matter from one galaxy to another

Astronomers are well aware of the phenomenon of matter flowing from star to star or from one galaxy to another. It was called “drag and drop frames”. This phenomenon is especially clearly observed in “close systems of binary stars or galaxies” (Figure 8). This figure clearly shows the peculiarity of this process, which consists in the invariance of the position of the centers of star clusters, while the peripheral layers move with acceleration. This is explained by the fact that $\nabla\rho = 0$ at the cluster centers, while it is violated for the peripheral layers. As a result, one star or galaxy, as it were, “undresses” another. At the same time, it is not necessarily the smallest of the galaxies that “undresses”: everything depends on the spontaneously arising matter density gradient in a particular region of space, as follows from the bipolar law of gravity (18). This is clearly seen from Figure 8, where the sleeve of a large galaxy, accelerating as it approaches the small galaxy, gradually thins and heats up. Such threads permeate the entire visible part of the Universe, which was the reason to call them “the web of the Universe.” Its presence indicates the prevalence in space of the phenomenon of the flow of matter from one star or galaxy to another.



Figure 8 The flow of matter from a large galaxy to a small one.

“Black holes” as “factories of stars”

Nobel Prize Winner 2018 R. Penrose explained the occurrence of black holes by gravitational collapse, i.e., catastrophically rapid compression of massive stars under the action of gravitational forces after the depletion of their thermonuclear fuel supply. In contrast, the energy-dynamic theory of gravity claims that the star did not have any initial “reserves” of thermonuclear fuel. On the contrary, these reserves were created gradually due to the condensation of the latent mass, accompanied by the absorption of its energy (~ 935 MeV/a.m.u.), nucleosynthesis, and subsequent complication of chemical elements. Further, black holes, by definition, have such a powerful gravitation that even light cannot escape it. According to the bipolar law of gravity (18), this state is reached gradually as the latent mass becomes denser. Therefore, it is more natural to assume that black holes are the product of evolution, and not “collapse”, and are formed from “voids” as the density increases to a state sufficient to “hold the light.” But even then, the stellar matter “sucked in” into the black hole does not disappear but increases in concentration until it starts to escape from the black hole in the form of “jets” from their center, where the relative density gradient $\nabla\rho/\rho$ and the gravitational force are minimal (Figure 9) When these processes intensify, black holes turn into zones of increased luminosity, observed as a bright spot in the center of the galaxy. Thus, black holes are not “gravediggers” but “factories” of stars.



Figure 9 Jets emitted by spiral galaxies.

All this testifies to the ability of the energy-dynamic theory of gravity to explain the observed phenomena, and not to pile up paralogisms and mysteries of the world around us.

Thus, the proposed approach to building a model of the evolution of the Universe “from scratch” allows us to give a consistent explanation of various phenomena occurring in the Universe, including the ordered arrangement of galaxies and the nature of rotational curves, to explain the causes of cosmological singularities and periodic “big bangs”, to propose a field form the law of gravity and the soliton-like model of the atom, to substantiate the wave concept of the universe, to outline a direct path to the creation of a unified field theory, and ultimately to eliminate the negative attitude towards the “perpetual motion” of the Universe and the attempts of engineers to recreate it in technic.

Conclusion

The proposed consideration of the processes in the Universe “from scratch” allows us to give a strict logical and mathematical justification for its non-equilibrium (spatial heterogeneity) and the validity of the principle of the opposite direction of non-equilibrium processes, which results in the presence in it of two interconvertible phases of matter, which it is appropriate to call it structured and unstructured matter (“baryonic” and “non-baryonic”) or “substance” and “hidden to the masses”.

Consistent application of the principle of opposite direction makes it possible to prove in a logical-mathematical way not only the principle of proportionality of the mass and energy of the hidden mass, but also to obtain on its basis a number of consequences of paramount importance regarding the incompressibility of field media; the inevitable occurrence of density fluctuations (gravitational waves) in them; fundamental unity of “man-made” and “non-man-made” energy converters; non-negativity of potential energy; indistinguishability of “attraction” and “push”; the existence of “gravodynamic” energy; “strong gravity”; superluminal speeds; field form of the law of gravity; gravitational equilibrium and the possibility of the functioning of the Universe, bypassing the state of equilibrium.

In the same way, one can come to the conclusion that the main form of energy in the Universe is gravitational energy, which includes gravitastic and gravodynamic components. The latter arises due to the instability of the inhomogeneous state, which leads to the involvement of a part of the hidden mass in the oscillatory motion. This part of the energy can be easily converted into any other form, due to which the work “against equilibrium” is performed in the process of turning the hidden mass into matter and its further structuring.

The “fuel” for stars as miraculous converters of the energy of the hidden mass into matter and radiation is an unobservable ether-like (non-material) component of the cosmic environment, which, according to modern data, makes up at least 95% of the mass of the entire Universe and is called “hidden mass”, “physical vacuum”, “dark matter”, “dark energy”, etc. This medium lowers its potential in the process of its transformation into matter from $\psi_g = c^2$ to $\psi_k = c^2/n_k^2$, which makes the transformation of energy in the Universe spontaneous and subject to the usual laws of thermodynamics.

The “mechanism” of this transformation is similar to condensation and consists in the formation of soliton-like wave structures in the hidden mass, including the nuclei and shells of atoms, with their subsequent association into molecules, gases, liquid and solid substances, dust-gas clouds, small and large celestial bodies, stars, galaxies and their clusters. Their spontaneous occurrence in various regions of the Universe leads to a further increase in the inhomogeneity of the matter field and the formation of stars with thermonuclear reactions occurring in them, which ends with their “explosion” when the internal pressure exceeds the forces of compression and to the subsequent “rupture” with the return of matter to its original state.

Such an approach does not go beyond the scope of classical physics and at the same time opens a direct path to the creation of a unified field theory, allowing you to propose a wave concept of the universe, give a consistent explanation of the origin of various forces and their fields, a soliton-like model of the atom, the equation of the Universe, the field form of the law of gravity, justify the ordered arrangement of galaxies and the nature of rotational curves, explain the causes of cosmological singularities and periodic “big bangs”, and ultimately - to substantiate the idea of the Universe as an “eternal” energy converter that does not contradict the laws of thermodynamics. al devices.

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Conflicts of interest

Author declares that there is no conflict of interest.

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