

Approaches to the study of little-studied natural phenomena

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The mechanical structure of the Universe Mechanical equivalent of electricity

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The work is a development of the concept set out in the monograph "Mathematical Foundations of Ether Mechanics". After the creation of the STR, physics abandoned the concept of the world environment. The further development of physics in the 20th century is only a mathematical description of experiments, without constructing mechanical models. The monograph sets out the foundations of the new mechanics of the world environment. The solution is philosophically deeper, but mathematically simpler. Newton's physics is not mechanics, since it contains the substantial quantities of mass and time. The main provisions of the theory are briefly outlined, a rational explanation of the Michelson experiment is presented, and the concept of "mechanical equivalent of electricity" is introduced.

Descartes' main idea is the idea of the mechanical structure of the Universe, that is, mechanical, visual models should be built for all natural phenomena. The idea aroused great enthusiasm among scientists of that time. However, gradually the proposed models began to cross the boundaries of common sense. Not supported by mathematics, the models became fantastic, and trust in Cartesianism fell. Newton developed mathematical methods for studying movements. These methods entered science under the name "Newtonian Mechanics".

However, having the name "mechanics", Newton's physics does not provide a mechanical, model explanation of the basic physical quantities. For example, the concept of "mass" in modern physics leads to abstract concepts. An even more mysterious quantity is the quantity "time". If for the quantity "mass" Descartes' followers (for example, E. Mach [4]) still tried to find a mechanical model, then for the quantity "time" there were no mechanical models even in the form of hypotheses. This gives grounds to assert that Newton's physics is not mechanics, since it contains substantial quantities. Newton's theory of motion should be called *Newton's substantial physics*.

In the further development of physics, the periods of Cartesianism and Newtonianism alternated. The 18th century is the period of "weightless", that is, substantialism. In the 19th century, there was a search for mechanical models. Science of the 19th century had no doubts about the mechanical nature of natural phenomena. *"From the totality of these new tendencies, the final goal of the development of physics is becoming increasingly clear - the creation of a unified science of physics as the mechanics of all matter, as the kinetics of all material movements ..."* [5, p. 189]. However, in the 20th century, a new turn in the history of science took place on the path of substantialism. The decisive role in this turn was played by the Michelson experiment and the creation of the STR to explain the experiment.

In 1879, D.K. Maxwell proposed a scheme for an experiment to detect the world environment (ether). Within the framework of Newtonian mechanics, the experiment was guaranteed to determine the presence of the environment. In 1881, A. Michelson managed to carry out this experiment. The device he designed has since been called **the Michelson interferometer**. The principle of the device is based on measuring the difference in signal travel times in two different directions: 1) in the direction of the Earth's velocity and back; 2) in the direction perpendicular to the Earth's velocity and back.

recorded differences in signal propagation times

The experiment is not
Since then, quality and technology

The experimental procedures are constantly improving, but no positive results have been obtained in detecting the global environment.

Physics of the late 19th – early 20th century found itself in a state of confusion. In these conditions, A. Einstein proposed the special theory of relativity. Despite the esoteric nature of the theory, the results of the dynamics of STR coincided with the experiment. Therefore, physics accepted STR as a theory of space-time. As a result, the ether, in the existence of which almost all the founders of physics as a science were confident, found itself "overboard of science".

1. Problem and solution

1.1 The Mystery of the Michelson Experiment

According to Newton's idea [1], there is a fundamental quantity **time** Nt , flowing uniformly throughout the entire infinite space. According to this idea, the speed of light c is equal to the distance $\tilde{y}l$ $\tilde{y}t$:

$$c = \frac{\tilde{y}l}{\tilde{y}t} \quad (1)$$

Where: $\tilde{y}t$ is the time interval according to Newton.

The experiment proposed by Maxwell is based on this relationship. The Michelson experiment gave a positive result. The absence of such a ~~should have~~ grounds to doubt the foundations of Newtonian mechanics, including formula (1). STR formally solved the problem, but at the same time distorted the foundations of physics so much that disputes about the truth of STR continue to this day. The provisions of STR, which cause the most

The heated debate is as follows:

- 1) Removal of ether from scientific use;
- 2) Lack of mechanical, visual models of phenomena;
- 3) The esoteric nature of the introduced concepts (for example, the concept of four-dimensional pseudo-Euclidean space-time).

The esoteric ideas of STR contributed to a change in the mentality of the scientist. The main feature of the new mentality is the idea that there are some mysterious laws in the Universe that cannot be understood logically; one can only create some approximate mathematical descriptions of these laws. Physical theories of the 20th century were created in this spirit.

1.2. Solution

In the monograph [3] and subsequent works of the author of this concept (hereinafter referred to as the Author), an alternative explanation of the Michelson experiment is given. The meaning of this explanation, in brief, can be expressed by the following statement: **Statement 1:**

$$E = cQ \quad (2)$$

Since this dependence is linear, it is observed **any inertial system**
countdown This hypothesis immediately, without additional conditions, explains Michelson's experiment. and other experiments in which it was established that the "speed of light c " is an invariant. However, another, more large-scale task arises: the construction of a theory in which assertion 1 would be further developed. The foundations of this theory are set out in the monograph [3].

The main conclusion from the ideas that arose in me about 45 years ago was the conclusion that a simpler explanation of the phenomena of Nature is possible than the description provided by 20th century physics. The continuous search for physical ideas that provide visual explanations for the experiments of the late 19th – early 20th centuries, which lasted for 27 years, yielded results: a set of ideas was found that explain the “fantastic” properties of the world environment – the ether.

Ideas and consequences that bring classical simplicity back to science

Idea 1: Newton's physics, called Newtonian mechanics, is not mechanics, since it contains the substantial quantities mass and time;

Consequence: On this basis, a rational explanation is given for Michelson's negative result.

Idea 2: The existence of a circulation of surface forces. This idea is extremely fruitful and has at least four important consequences:

Corollary 1: Explanation of the transverse nature of EM waves;

Corollary 2: Explanation of the genesis of the quantity “electron charge”;

Corollary 3: Analytical proof of de Broglie's formula;

Corollary 4: Discreteness of interactions

Idea 2 does not require philosophical justification, so it will be considered in the following exposition. But idea 1 is new to the whole philosophy of Nature since Newton. Without a doubt, the problem of the ether is the greatest scientific problem and it would be, at least, surprising if the greatest problem were solved without ideas that shook physics to the core.

the very basics.

In the monograph [3] and in the works [6 - 10] a concept is presented according to which the experiments of the end of the 19th – beginning of the 20th century are explained mechanically. The interpretation of the experimental facts is presented from the standpoint of the kinetic theory of matter, according to which all space is filled with a homogeneous medium (ether) and vortices can exist in the ether. The verbal formula of the kinetic theory of matter:

SUBSTANCE (AND FIELD) = MATTER (ETHER) + MOTION According to (I), ether at (I)

rest has no properties (including mass). If mechanical motion is introduced into ether, then substance or field appears. All properties of objects of the material world are attributes of mechanical motion. In this case, the concept of *Mechanics* is radically adjusted. According to the presented concept, mechanical quantities are *mass* and *time*, which are fundamental quantities in Newtonian physics. Michelson's experiment, which cannot be understood within the framework of Newtonian physics, receives a simple explanation from the position that time is not a fundamental quantity, but a function of mechanical quantities. The experiments that led to the emergence of quantum mechanics are explained by a model, as mechanical phenomena occurring in ether. The de Broglie equation, which has no model interpretation in modern physics, is an equation of stationary motion of a vortex ring in ether. A hypothesis is introduced that the ring in the ether is the “elementary particle of electricity” - the electron. All experimentally known properties of the electron must be explained as properties of the ring in the ether. “The charge of the electron” is an attribute of the mechanical motion of the ring. Further development of the theory follows the path of more rigorous proof of the presented ideas. Based on the equation of motion of the ring - electron, in [3] the primary calculation of the electron parameters was made. In [10] the correction of the calculations of the electric charge was made. A calculation technique based on the existence of a “mechanical equivalent of electricity” was developed.

2. Brief outline of the concept

2.1. Ether Model

In the distance-mass-time system lmt , Newtonian physics, the quantities mass and time do not have a model interpretation. Therefore, we introduce the mechanical system distance-energy-momentum E, Q .

Let there be a continuous superfluid medium consisting of point particles that, like a photon, have no rest mass. If the medium is at rest, then the energy density and, accordingly, the mass density are zero. If the ether points are moving, then, like photons, they have energy and mass. The dependence of the energy of a unit volume of the medium on the magnitude of the momentum is the same as dependence (2) for a photon. For a photon, the formula $E = cQ$ means that the energy E of a photon is equal to the

product of the speed c of the photon and the magnitude of the momentum Q . But in the system E, Q the concept of time is absent, therefore there is no concept of the speed of light. The quantity c is not the speed of light, but a proportionality coefficient in the linear dependence (2). The quantity c is measured not in meters per second, but in units of $[E/Q]$ *energy momentum*

$$E = cQ \quad (3)$$

The equation of motion of the ether is written in the following form [3, p. 108]:

$$\nabla \cdot \mathbf{a} = \frac{1}{\rho} \nabla \cdot \mathbf{p} \quad (4)$$

The active vector in equation (4) is the vector \mathbf{a} . The modulus of the vector \mathbf{a} is equal to the geometric mean of the moduli of the vectors \mathbf{c} and \mathbf{q} :

$$a = \sqrt{c^2 + q^2} \quad , \quad \text{or} \quad q = \sqrt{a^2 - c^2} \quad , \quad (5)$$

where: \mathbf{q} is the momentum density; c is the energy density. For comparison,

we write down the Euler equation of an ideal medium [11, p. 16]: (Euler, 1755)

$$\frac{1}{\rho} \frac{d\rho}{dt} + \nabla \cdot \mathbf{v} = 0 \quad (6)$$

Where: t_{Eu} - Euler time. It is believed that "Newton time" and "Euler time" are identical concepts. However, this is not so: Newton time flows always and everywhere, and Euler time does not flow in stationary processes, since $\frac{d\rho}{dt} = 0$. Comparison of equations (4) and (6) shows,

firstly, that the ether equation (4) is simpler than the equation of macroscopic media. Secondly, the ether equation does not have a partial derivative with respect to time. However, the equation is valid for both stationary and non-stationary modes. Indeed, the arguments of motion - energy E and momentum \mathbf{Q} are implicitly present in the right-hand side of the equation, regardless of whether the process is stationary or non-stationary. In the medium described by equation (4), various types of flows are possible. Since the motion is potential, there is a potential ϕ of the vector \mathbf{a} .

$$\nabla \times \mathbf{a} = 0 \quad (7)$$

The meaning of the subscript 0 in the vector \mathbf{a}_0 will be explained later. All possible flows must be a combination of the simplest flows of the medium. The simplest, physically possible flow is a vortex ring in the ether.

On the basis of such a simple model of ether, all the diversity of the properties of the Universe should be explained. Obviously, ether in a state of rest does not have the properties of "mass", "time", 366

"charge". The genesis of these properties occurs when mechanical energy is introduced into the ether movements.

2.2. Mass as an attribute of mechanical motion

The vectors \mathbf{c} and \mathbf{q} coincide in direction, so we can introduce a scalar function

$\vec{y}(\vec{y})$, which establishes proportionality between these vectors: (\vec{y})

$$\mathbf{q}^{\gamma} = \ddot{\mathbf{y}} \ddot{\mathbf{y}}^T \mathbf{c} . \quad (8)$$

The relation (5) will be written as follows:

$$\ddot{y} = \ddot{y}_{\text{v}\ddot{y}\ddot{y}\ddot{y}} \mathbf{c} \mathbf{q} \mathbf{c} \mathbf{q} \mathbf{a} \text{ From } \ddot{y}^2 \mathbf{c} \quad (9)$$

relations (5) and (9) the following relations follow: **ca** \ddot{y} /

$$\sqrt{\ddot{y}} \quad (10)$$

$$q_{\alpha} \ddot{y} \sqrt{\ddot{y}} \quad (11)$$

Size $\bar{\rho}(\mathbf{r})$ in (8) and (9) can be considered as a variable mass density of the moving ether.

In integral form, relation (9) is written as follows

$$E_{\text{cded}}^{\text{cded}} \gamma c^{222} \ddot{\gamma} \ddot{\gamma}_{\ddot{\gamma}} \quad (12)$$

We obtain the value "mass" not as an argument of motion, but as a function of mechanical quantities E, Q .

The dimension of this function is: $\frac{1}{m} [m \text{ QE} \ddot{y}]$

2.3. Time as an attribute of mechanical movement

The fundamental quantity "time" does not exist. The process of changes occurring in Nature is not due to the existence of a mystical quantity "time", but to the convection of quanta

field changes.

Let there be an object A creating some field at a point B at a distance l . If $\frac{dl}{dt}$, located on changes occur with object A object A to point B with "speed" $\frac{dl}{dt}$, then the quantum of field disturbances comes from c , determined from (2). The term "speed" is in quotation marks, since the value c is not the speed of a quantum, but the proportionality coefficient in (2). We obtain an "elementary time interval" $\dot{y}t$:

$$\ddot{y} \dot{y} t / l c / \quad . \quad (13)$$

The more fundamental quantity in (13) is the quantity c ; the quantity $\dot{y}t$ is secondary. The function "time" can be introduced as a sum:

$$t \ddot{y} \ddot{y} \ddot{y}, \quad t_i \quad (14)$$

where: N is the number of quanta of field

changes. The synthetic value t in (14) is a function of "time" measured in units of $[\hbar / IQ E \ddot{y}]$. This relationship shows that time "flows" only when changes occur. In stationary and static modes, time "does not flow". The "flow of time" in different objects of the Universe is not the same. For example, in an atom in a stationary state, time "does not flow". The partial derivative with respect to time $\ddot{y} \ddot{y} / t$ is some

or quantities \ddot{y} is not equal to zero only in those systems in which changes exist.

Thus, instead of the Newtonian concept of time, a more complex concept of time is introduced, the flow rate of which is variable.

Since the quantity "time" does not exist, the concept of the velocity V of a body as a derivative of distance with respect to time also does not exist. The concept of the translational velocity V of a body can be introduced, similar to the Hamiltonian formulation of dynamics, as a derivative of the energy of motion T of a body with respect to momentum

$$V = \frac{dT}{dQ} \quad (15)$$

3. Problems of the ether theory of the XIX century and their solutions

In the 19th century, properties of ether were experimentally discovered for which no explanation had been found. These are three groups of experiments:

Problem 1. Transverse electromagnetic waves;

Problem 2. The impossibility of detecting ether by direct experiment;

Problem 3. Impossibility of constructing a mechanical model of charge.

The inability of the theory to explain these experiments led to the fact that by the end of the 19th century, the ether models had become so artificial that no one believed in such models any more. Therefore, after the creation of the STR, the concept of ether was abandoned. The presented concept states that the reason for the impossibility of constructing a satisfactory model of the medium is that physics tried to create a model of ether within the framework of Newtonian physics. In [3], [10], two errors of 19th century physics are revealed and solutions are presented:

Solution to problems 1 and 3: existence of surface force circulation along the contour vortex ring.

Solution to problem 2: Misconception about the quantity "time".

3.1 Transverse electromagnetic waves

If we consider light as waves in the ether, then experiments on light polarization prove the transverse nature of these waves. For this, the equation of an ideal medium must contain a rotor or circulation of surface forces. Such a conclusion contradicts the ideas of science about an ideal medium. There is a theorem of Lagrange, according to which the propagation of vortex motions through an ideal medium is impossible. During the 19th century, this problem was never solved. This problem was solved by the Author. Ether movements are potential, there is no acceleration circulation along a closed circuit, so the searches of 19th century science in this direction

are erroneous. **The principle of the solution is that there is a circulation of surface forces along the vortex circuit** described in world literature: circulation exists in an integral form, the transition to a differential form is impossible. The transverse nature of EM oscillations is a consequence

rings.

the existence of not a rotor, but the circulation of surface forces along a finite contour.

To prove this, we consider the field of a ring in an ideal medium described by the Euler equation (6). The field of the ring is described by Ampère's theorem [12, p. 290]:

$$\mathbf{v} = \frac{1}{4\pi} \oint \frac{\mathbf{r} \times d\mathbf{r}}{r^3} \quad \text{(Ampere, 1820)} \quad (16)$$

Where: of particles of the medium created by the vortex ring; \mathbf{r} - circulation; \mathbf{v} -

surface stretched over the contour of the ring; n is the normal to the surface \mathbf{r} ; r is the distance from the surface \mathbf{r} to the point under consideration.

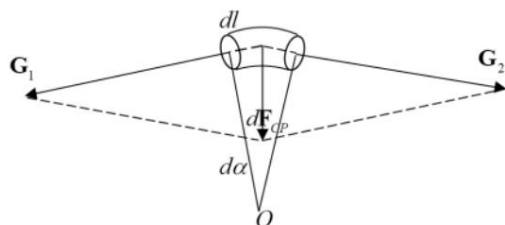


Fig. 1. Origin of the force dF_{CP} directed towards the center O of the ring

The theorem was obtained by Ampere under the assumption that the motion of the medium is potential. But in the works [3], [7] it is shown that there is a circulation of surface forces along the contour of the ring. To prove this,

we will consider the stationary motion of the ring in the medium described by equation (6). During stationary motion, there is an equality of forces acting on the element dl rings: centripetal force dF_{CP} , and centrifugal force dF . The origin of the force dF_{CP} is illustrated in Fig. 1.

The ends of the element dl are subject to two equal tensile forces G_1 and G_2 directed along the normal to the plane of the section. The magnitude G of these forces can be calculated as follows [3], [8]:

$$G = \lim_{\Delta \alpha \rightarrow 0} \int_{\Delta \alpha} \ddot{y}(\alpha) \rho d\alpha = \ddot{y} R, \quad (17)$$

Where: \ddot{y} - cross-section of the vortex; 0 ρ - pressure at infinity; p - pressure in cross-section of the vortex.

Since the element dl is bent, a resultant dF_{CP} of forces G_1 and G_2 arises, directed towards the center of the ring

$$dF_{CP} = G d\alpha, \quad (18)$$

where: $d\alpha$ is the central angle of the element dl .

Since the element dl moves with a translational velocity V_{CIRC} , the force $dF_{Zhukovsky}$ acts on it

$$dF_{Zhukovsky} = \rho_E V_{CIRC}^2 R d\alpha, \quad (19)$$

Where: ρ_E - density of the Euler fluid; R - radius of the ring. Equating (18) and (19), we obtain

$$V_{CIRC}^2 = \frac{G}{\rho_E R}. \quad (20)$$

Multiply the numerator and denominator of the right side (20) by the circumference of the ring $2\pi R$.

The numerator in this case can be represented as **the circulation of the surface force G** along the contour L of the ring:

$$V_{CIRC}^2 = \frac{1}{2\pi R^2 \rho_E} \oint_L G dl. \quad (21)$$

The translational velocity of the **VCIRC ring** can be expressed as a function **circulation surface force G** . As is known, the potentiality of surface forces lies in

based on the dynamics of ideal media, therefore the proof of the existence of surface force circulation introduces major changes into the theory. The author has investigated two main consequences:

- 1) The emergence of an addition to Ampere's theorem (16). This addition provides an explanation of the genesis the quantity "electron charge";
- 2) The possibility of explaining the transverse nature of electromagnetic waves.

Let us consider how the addition to Ampere's theorem arises. The motion is not potential, since there is a circulation of surface forces. Therefore, Ampere's theorem will be valid not in a fixed coordinate system, but in a system moving with velocity V_{CIRC} . To move to a fixed coordinate system, we must add velocity V_{CIRC} to the velocity field (16). We obtain the corrected Ampere theorem [3, p. 153]:

$$\mathbf{v}_{SUM} = \mathbf{v} + \frac{1}{4\pi} \frac{\nabla \times \mathbf{v}}{r} = \mathbf{v} + \mathbf{v}_{CIRC} \quad (22)$$

3.2. Michelson's Experiment

Consider the solution to Problem 2 of the 19th century ether theory. The density of ether at rest is zero; obviously, no direct experiment can detect such an object. For Newtonian physics, the ether of this model is not even an object, since it has no mass density. In various experiments, this general thesis takes specific mathematical forms. Consider what happens in Michelson's experiment (Fig. 2). Let us have a rod of length l . Let the rod initially be motionless relative to the ether. Light source L emits a light pulse that travels from one end of the rod to the other, is reflected by mirror S and travels back. In the reference frame CS_0 , motionless relative to the ether, the time it takes for the signal to travel there and back is:

$$t = \frac{l}{c}$$

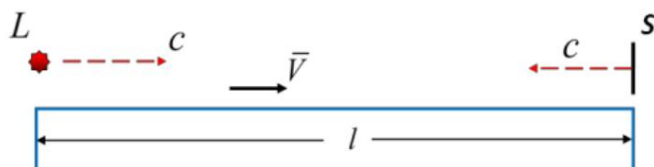


Fig. 2. Towards an explanation of the Michelson experiment

Now let the rod move with speed V in the direction of its length. If light is emitted by a moving body, then the quantum energy increases by the

value γE . But the quantum momentum Q also increases proportionally :

$$\gamma Q = \frac{E}{c}$$

According to (15), the value of the "quantum velocity" relative to the moving rod can be calculated as the derivative of energy with respect to momentum:

$$\frac{\partial E}{\partial Q} = \frac{\partial (\gamma E)}{\partial (\gamma Q)} = \frac{E}{Q} = c \quad (23)$$

The speed of a quantum of light relative to a moving inertial reference frame (IRF) of any IRF is always equal to this is the coefficient of linear proportionality dependence in V , since the value c

(2). Consequently, there are no deformations of the rods.

happens and Lorentz's formulas are wrong.

$$\begin{aligned} x' &= \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}; \quad y' = y \\ t' &= \frac{t - \frac{v}{c^2}x}{\sqrt{1 - \frac{v^2}{c^2}}} \end{aligned} \quad (\text{Lorentz}) \quad (24)$$

However, in STR there is a relationship between dynamic quantities

$$E^2 = c^2 Q^2 + m_0^2 c^4, \quad (25)$$

where: E is the total energy of the particle; \mathbf{Q} is the momentum of the particle; c is the speed of light; m_0 is the mass rest state of the particle.

Formula (25) has been verified experimentally, and there is no doubt about its validity. In STR, this formula was obtained using Lorentz's formulas; modern physics considers relation (25) to be the main proof of the correctness of STR. The position arises that Lorentz's formulas are incorrect, while the formulas for dynamic quantities of STR are correct. To overcome this contradiction, it is necessary to prove formula (25) without the help of Lorentz's formulas. **Theorem 1.** Formula (25) is valid for bodies moving in the ether, while space is three-dimensional and Euclidean

Proof of Theorem 1

Total momentum of a particle

$$\mathbf{Q} = m \mathbf{V} \quad (26)$$

where: m is the total mass of the particle; \mathbf{V} is the velocity of the particle. Vectors \mathbf{V} and \mathbf{Q} coincide in direction, therefore:

$$Q = mV \quad (27)$$

According to (12), the total mass

$$m = m_0 \sqrt{1 - \frac{V^2}{c^2}}$$

Speed V , according to (15)

$$V = \frac{c^2 Q}{E} \quad (28)$$

Formula (27) takes the form:

$$Q = \frac{E^2}{c^2 Q} \quad (29)$$

Relation (29) is a differential equation with separable variables E and Q :

$$\frac{1}{c^2} E dE = Q dQ \quad (30)$$

We integrate both parts

$$\frac{1}{c^2} E^2 = Q^2 + \text{const}$$

General solution

$$\frac{1}{c^2} E^2 = Q^2 + m_0^2 c^2, \quad (31)$$

where γ is an unknown constant. The constant γ is determined from the initial conditions.

If $Q \neq 0$, that $E = mc \gamma \dot{\gamma}^2$; From here $\dot{\gamma} = E_0 / mc$. Substitute into (31)

$$\frac{1}{2c} E_0^2 \gamma^2 = \frac{E_0^2}{c^2}$$

Or

$$E_0^2 \gamma^2 = mc^2 \left| \frac{2 \gamma^2}{2 \gamma^2} \right| \gamma^2 = 0$$

This is formula

(25), but it was obtained without using the Lorentz formulas. Theorem 1 is proven: based on this model of ether, experimentally confirmed formulas of STR for dynamic quantities – energy and momentum – were obtained.

Lorentz's formulas are losing

theoretical basis

and go into

Non-existence as the main source of pseudoscience of the 20th century

The given proof changes the priorities of physics. The formulas of STR for dynamic quantities are correct, but space is three-dimensional and Euclidean, which greatly simplifies the theoretical consideration of physical problems. However, physics of the first quarter of the 20th century

century rejected mechanical models of phenomena. As a result, a complex of sciences called "quantum physics" appeared. The presented concept shows that a rational explanation of experiments is possible precisely from the standpoint of the existence of ether.

4. Electron structure

The presented concept states that such abstract concepts of modern physics as "are properties of the electron as a vortex "electron charge e ", "wave function of the ring in the ether. γ

Let us introduce

the hypothesis that the electron is a vortex ring in the ether. Based on this hypothesis, in [3] an explanation is given of the nature of the "electric charge" of the electron as a mechanical property of the vortex ring, mechanical models of electromagnetism are constructed, and rational explanations are given for the experiments that led to the creation of the abstract science of "quantum physics".

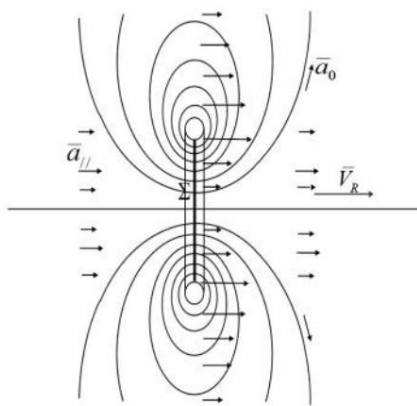


Fig. 3. Field of a freely moving vortex ring in the ether

Let us consider the genesis of the "electromagnetic properties" of matter. The results obtained in Section 3.1 for an ideal liquid can be transferred to a vortex ring in the ether. Ampere's theorem

$$\oint \vec{a} \cdot d\vec{\gamma} = \frac{C}{4\pi} \oint \frac{\vec{\gamma} \cdot \vec{\gamma}}{nr} d\gamma \quad (32)$$

Corrected Ampere's theorem [3, 7]:

$$\vec{a}_{R1} = \frac{C}{4\pi} \oint \frac{\vec{\gamma} \cdot \vec{\gamma}}{nr} d\gamma = \sqrt{\frac{\gamma}{2}} \vec{v}_R \quad (33)$$

Where: γA – Ampere potential; C – circulation of vector a_0 ; γ – surface,

based on the contour of the vortex ring.

The image of the field is shown in Fig. 3. The field consists of two components: 1) Lines - this term expresses Ampere's theorem; 2) Additional vector $a_{//}$. The modulus of the vector a_0 ,

according to (7) is defined as the square root of the energy density; in this vector $a_{//}$, case, the density of kinetic energy of the translational motion of the ring $\bar{y}_{//}$, at low energies equal to: $\bar{y}_{//} = \bar{y} / 2 \sqrt{V_R}$. Taking the root, we get: // (34) $a_{//} = \sqrt{\bar{y} / 2} \cdot V_R$

Relationship (33) gives an expression for the field of a freely moving ring in the ether. If the ring is stopped by external forces (Fig. 4), then the following process occurs. Energy the progressive motion of the thin ring cannot disappear, it is transformed into the energy of the progressive flow of ether. This flow moves with the speed c in the direction of the stopped progressive speed of the ring. The ring becomes a "micro-pump" driving the flow of the vector $//EM$ through itself. Let's call this flow **a co-current** flow. The total field consists of the sum of the Ampere field (32) and the co-current flow field:

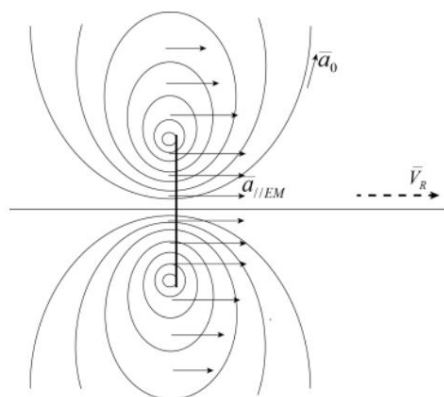
$$a_{R2} = \bar{y} \bar{y} \bar{y} \frac{C}{4} - \bar{y} \frac{\bar{y} \bar{y} \bar{y} 1}{\bar{y} \bar{y} \bar{y}} d\bar{y} = \bar{y} a_{//EM} \quad (35)$$

Let us make the following statement.

Statement 2. The average power of the vector flow $//EM$ there is a value, which appears in physics under the name "electron charge e ".

$$e = \bar{y} \bar{y} \bar{y} a_{//EM} = n \int d\bar{y}, \quad (36)$$

where: symbol \bar{y} denotes the average value; \bar{y} is the infinite plane of the transverse



sections.

The dimension of the flow power coincides with the dimension of charge e in the natural system of units

$$\bar{y} a_{//EM} T \bar{\theta}^{1/2 3/2} = 1, \quad \bar{y} \bar{y} \quad (37)$$

Fig. 4. Field of a ring stopped by external by forces

In [3] it is shown that the additive $a_{//EM}$ creates properties electron, which are designated term "electromagnetism", and the vector field a_0 creates a complex of phenomena that fall within the competence of quantum mechanics.

5. Quantum Physics

The theory presented builds simple, mechanical models of phenomena for which quantum physics does not provide visual models. First of all, it is an analytical proof of the de Broglie formula. **According to the proposed theory, the de Broglie equation is the equation of stationary motion of a vortex ring in the ether.**

This idea arose after the analogy between formula (20) and de Broglie's formula was noticed.

$$\frac{\bar{y}}{2\pi m V} = \frac{h}{2\pi m V} \quad (\text{de Broglie, 1923}) \quad (38)$$

Where: λ – de Broglie wavelength; h – reduced Planck constant; m – particle mass; V – particle translational velocity.

If we write formula (20) for the stationary motion of a vortex ring in an ideal Eulerian model fluids in the following form:

$$R_R = \frac{G}{\lambda E \lambda \lambda V_{CIRC}},$$

then it has similarities with the de Broglie formula (38): in both formulas the quantities either coincide or are close in meaning. Formula (20) was obtained by the Author in 1985, and expectations arose that if the ether equation was obtained, then the equation of stationary motion of a vortex ring in the ether would take the form of the de Broglie equation (38). These expectations were justified: in 2005, based on the already obtained ether equation (4), the equation of stationary motion of a vortex ring in the ether was analytically obtained

$$R_R = \frac{K}{m V_R}, \quad (39)$$

where: m is the mass-energy of the ring; R_R is the radius of the ring; V_R is the translational velocity rings; K is the angular momentum of the medium rotating around the circular axis of the vortex. If we assume that the magnitude of the moment K is equal to the constant h :

$$K = h, \quad (40)$$

and the length of the ring circumference $2 R_R$ is the de Broglie λ :

$$2 R_R = \lambda, \quad (41)$$

wavelength $R_R = \lambda/2$ then we obtain the de Broglie formula. Formula (39) takes the form:

$$R_R = \frac{h}{m V_R}. \quad (42)$$

Relation (42) is the equation of stationary motion of a vortex ring in the ether; we will call it **the electron equation**.

Theorem 2. The de Broglie equation is the equation of stationary motion of a vortex ring in the ether.

Proof of Theorem 2. Let us find out

what form relation (20), valid for a thin ring in an Euler fluid, takes in the case of a vortex ring in the ether. We consider the problem under simplifying assumptions, with the sole purpose of identifying the main regularity.

Let us consider the stationary motion of a thin vortex ring in the ether. On the element d the same forces act on the ring that were considered in 3.1 when analyzing a vortex ring in an Euler fluid (Fig. 1). During steady motion, there is equality between the "centripetal" force dF_{CP} , acting in the direction of the center of the ring, and the "centrifugal" force dF

dF_{CF} , acting from the center.

We consider the problem in a coordinate system associated with a vortex ring (Fig. 5). Consider the centripetal forces. We introduce a Cartesian coordinate system xOy : the direction of the x axis coincides with the direction of the ring velocity vector V_R , the y axis lies in

planes of the ring. We also introduce the polar system r, φ , where is the angle $\varphi = 0$ on the Ox axis.

Just as in the Euler fluid, in the ether the formula (17) is valid for the value of G . The expression for the value of the elementary "centripetal" force $dFCP$ acting on

vortex ring element dl , has the same shape (18).

Let us consider the cross-section of a vortex ring. To simplify the analysis, let the streamlines in the vortex be concentric circles. Let us consider the circular element $rr dr$,

cross section of the vortex. The contribution of dG to the force G , given by this element is equal to:

$$dG = \frac{1}{2} \rho_0 \omega^2 r dr$$

because

$$\omega = \frac{v}{R}$$

Contribution of a circular element to the "centripetal" force $dFCP$ created

element dl , is equal to:

$$dF_{CP} = \frac{2 \rho_0 \omega^2 r dr dl}{R} \quad (43)$$

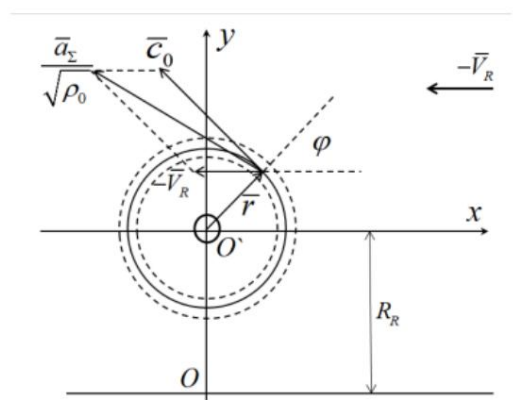


Fig. 5. Simplified image of the cross-section of a vortex ring by a plane passing through the center of the ring, in a moving coordinate system; O is the center of the ring, O' is the center of the vortex, R_R is radius of the ring. The dotted circles represent a circular vortex element of thickness dr , inside which the investigated current line is located

vectors a_0

Let us analyze the centrifugal force acting on the element dl . Let us consider the flow line in the circular element $rr dr$. Let us determine the total vector \vec{y} formed during the run-up

ether on a moving vortex. The modulus of the vector a_0 on the considered flow line before summation with the oncoming flow is equal to:

$$a_0 = \frac{1}{2} \rho_0 \omega^2 r \quad (44)$$

When adding the vortex vector a_0 to the oncoming flow, the resulting vector \vec{y} is formed.

which can be defined as follows. Let us define the velocity vector \vec{c} in the vortex.

modulus of this vector according to (10) is: $|\vec{c}| = \frac{v}{R}$, and the direction coincides with

direction of the vector a_0 . Then the vector \vec{c} summed with the velocity vector of the incoming

flow \vec{v} . We obtain the vector \vec{y} , the square of which is equal to:

$$\vec{y}^2 = \vec{c}^2 + \vec{v}^2 + 2 \cos(\theta) \vec{c} \cdot \vec{v}$$

Where α is the angle between vectors \vec{c} and \vec{VR} .

The square of the sum vector \vec{a} is equal to:

$$\vec{a}^2 = \vec{c}^2 + V^2 R^2 \sin^2 \alpha \quad (45)$$

Where: ρ_0 – the mass density of the ether on the current line under consideration;

$$\vec{a}^2 = \vec{c}^2 + \frac{V^2 R^2}{c^2} \frac{2 \sin \alpha}{c} \vec{c} \cdot \vec{V};$$

α – angle between the axis Ox and the radius vector r drawn from the center

O to point M , in which the summation of vectors \vec{c} and \vec{VR} .

When the oncoming flow passes through a vortex, a centrifugal force arises

dF_{CF}

(analogous to the Zhukovsky force in the Euler fluid), directed from the origin of coordinates O towards increasing values of y . At the same time, due to the symmetry of the distribution pattern

pressures relative to the y -axis, the sum of the projections of the forces acting along the x -axis is equal to zero.

Force dF_{CF} , acting on the element dl of the ring, is calculated using equation (4), where

square of vector \vec{a} is determined by the relation (45). Projecting the obtained relation onto

y axis, we get:

$$\frac{dF_{CF}}{dl} = \rho_0 \left(c^2 + V^2 R^2 \sin^2 \alpha \right) \frac{y}{r} = c^2 V^2 R^2 \frac{y}{r} \sin^2 \alpha.$$

The derivative on the right side is equal to:

$$\frac{d}{dy} \left(\frac{y}{r} \right) = \frac{1}{r} - \frac{y}{r^2} \frac{dr}{dy} = \frac{1}{r} - \frac{y}{r^2} \frac{2y}{2\sqrt{r^2 - y^2}} = \frac{1}{r} - \frac{y^2}{r^3} = \frac{r^2 - y^2}{r^3} = \frac{\cos^2 \alpha}{r}.$$

Substituting this derivative into the previous expression, we obtain:

$$\frac{dF_{CF}}{dl} = \rho_0 \left(c^2 + V^2 R^2 \sin^2 \alpha \right) \frac{y}{r} = \frac{2y}{r} \rho_0 c^2 V^2 R^2 \cos^2 \alpha \quad (46)$$

To calculate the contribution created by a circular element of thickness dr and length dl , we multiply (46) by the volume

element $dr dl$ and integrate over the angle α from the corner

$\alpha = 0$ to 2π . We get:

$$dF_{CF} = 2\rho_0 c^2 V^2 R^2 \cos^2 \alpha d\alpha dr dl \quad (47)$$

Thus, expressions (43) and (47) for the centripetal and centrifugal forces are obtained,

acting on the elementary layer $dr dl$. During steady motion, the centripetal and centrifugal forces acting on each layer are equal. Therefore, we equate expressions (43) and (47):

$$\frac{2\gamma}{R} \int_0^R q r dr dl = 2\gamma \int_0^R q r dr dl \quad (48)$$

Now we need to integrate (48) over the radius r from 0 to R , where R is the radius of the ring, where 0 is the radius of the cavitation cavity in the center of the vortex. Before integrating, we multiply both parts of (48) by the radius. Since the density depends on the radius, we write the density without the index 0 . Having reduced by the amount c , we write the integration in the following form:

$$\frac{dl}{R} \int_0^R q r r^2 dr = \int_0^R \gamma \gamma^2 2 r dr \quad (49)$$

Strictly, the upper limit of integration should not be R , and the radius R of the ring, however, for an infinitely thin ring these integration limits are equivalent. When integrating (49), the integral on the left side is equal to the angular momentum dK of the medium rotating around the element dl of the vortex filament:

$$\frac{dK}{dl} = \int_0^R q r r^2 dr$$

and the integral on the right side is equal to the mass per unit length of the vortex filament:

$$\frac{dm}{dl} = \int_0^R \gamma \gamma^2 2 r dr$$

Integrating over the entire length of the ring circumference, we obtain:

$$\frac{K}{R} = V_R m, \quad \text{or} \quad R = \frac{K}{m V_R}$$

This is formula (39). In this formula, K is the angular momentum of the medium rotating around a closed vortex thread:

$$K = \int_0^R q r r^2 dr = 2 \int_0^R \gamma \gamma^2 r dr \quad (50)$$

m – mass-energy of the medium participating in the vortex motion:

$$m = \frac{1}{c^2} \int_0^R \gamma \gamma^2 r dr$$

Theorem 2 is proved; formula (39) coincides in structure with de Broglie's formula (38). The very fact of this coincidence testifies to many things: it is unlikely that this coincidence can be accidental. However, in order for the presented interpretation of de Broglie's formula to become a theory, the quantities considered in this proof must be calculated. In [3] these quantities are calculated and estimated. Such an interpretation of de Broglie's formula makes it possible to provide visual mechanical explanations of the experiments carried out at the beginning of the 20th century.

centuries. In [3] rational explanations are presented for the following properties of the electron: 1. Uncertainty of the electron's position; 2. Dimensions of the electron; 3. Wave properties of the electron; 4. Electron spin.

6. Mechanical models of electromagnetism

6.1. Electrostatics

There are fundamental difficulties in the Maxwell-Lorentz theory of electromagnetism. One of these absurdities is the "point charge paradox", according to which the self-energy of an elementary charge is infinite. In the theory presented, such absurdity does not exist.

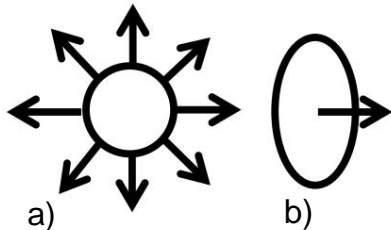
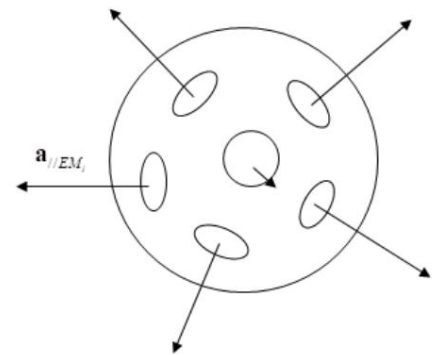


Fig. 6. Geometric structure of the elementary charge: a) in the Maxwell-Lorentz theory; b) in the presented theory

In the Maxwell-Lorentz theory, the elementary charge is similar in geometric structure to a macroscopic charged sphere (Fig. 7). In the theory being presented, the elementary charge is a vortex ring in the ether, i.e., geometrically it represents one line of force, orthogonal to the plane of the ring. A charged sphere is formed on the basis of such a spherically asymmetric structure.

Fig. 7. Formation of a spherically symmetric charged ball based on spherically asymmetric elementary charges

Let there be a conducting body in which an excess of such vortex rings is created (Fig. 7). Due to their ability to move automatically, the rings tend to the surface of the body, stop on the surface and create a field of vector \mathbf{a} in the surrounding space. The field of each ring is described by expression (35). The total field is equal to the vector sum of the fields of all rings. There is a theorem of hydrodynamics, also applicable in electrodynamics, according to which the vector sum of the fields created by dipoles distributed over a sphere is equal to zero [12, p. 291], [13, p. 73]:



$$\oint_C \mathbf{a} \cdot d\mathbf{r} = 0, \quad (51)$$

\mathbf{a} – vector of the field, $d\mathbf{r}$ – vector along which

where: \mathbf{r} – surface resting on the contour of the ring; \mathbf{a} – vector of the field, $d\mathbf{r}$ – vector along which vortex rings are distributed.

Therefore, the first terms on the right-hand side of (35) cancel each other out. The field created by each ring. This is around the ball is equal to the geometric sum of vectors $\mathbf{a}_{//EM}$,

there is an electrostatic field. Vector $\mathbf{a}_{//EM}$ in electrostatic mode corresponds

electric field strength \mathbf{E} of the Maxwell-Lorentz theory:

$$\mathbf{a}_{//EM} = \mathbf{E} \quad (52)$$

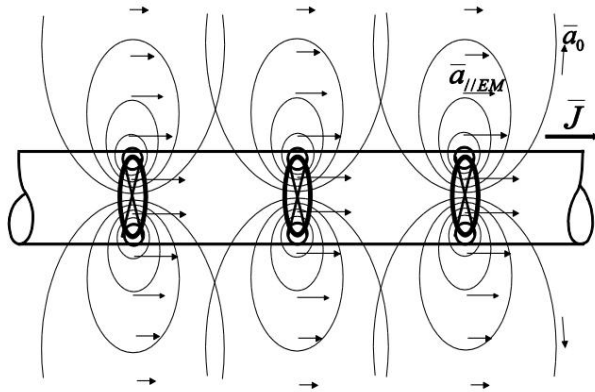
In [3] it is shown that bodies covered with such rings interact with each other in accordance with the experiment. Coulomb's law is analytically proven.

6.2. Constant magnetic field

From the standpoint of the theory presented, there are no separate "entities" – an electric field and a magnetic field: these fields are different manifestations of the same vector.

$\mathbf{a}_{//EM}$. In electrostatic mode vector $//EM$

around a charged ball, which is perceived at the macroscopic level as an electrostatic field. In the DC mode, the vector $//EM$ takes on a different shape.



a

Fig. 8. Image of a rectilinear section of a circuit with current

Let us consider the picture of the creations magnetic field. Let there be a closed conducting circuit in which, with the help of a current source, the axes of the vortex

rings are oriented along the contour in one direction. Fig. 8 shows a segment of this contour. We consider all the rings to be identical, and we also consider the distances between the rings to be equal. The cores of the rings are

slowed down by external forces, and the fields of the rings move freely in the surrounding space.

In this concept of the magnetic field, the electrons do not move along the conductor. As shown in Section 4, under these conditions each ring produces a flux of vector $//EM$. The fluxes circulate around the circuit with velocity c . The field of each ring is described by the relation (35) for the vector \mathbf{a} . The

\mathbf{a}_{R12} total field of the vector \mathbf{a} at any point P outside the wire is equal to the sum of the vectors $R \mathbf{a}_i$, created by all N rings:

$$\mathbf{a}(P) = \sum_{i=1}^N \mathbf{a}_i(P) \quad (53)$$

However, a theorem can be proved that the first term in (53) is equal to zero; for the proof, see [3, p. 170], [8]. Consequently, the field of the vector \mathbf{a} at the point P is equal to the sum

vectors $//EM \mathbf{a}_i$, created by all rings:

$$\mathbf{a}(P) = \sum_{i=1}^N \mathbf{a}_i(P) \quad (54)$$

Total vector field $//EM \mathbf{a}$, distributed in the space around the current-carrying wire, and there is a magnetic field. Therefore, in the presented concept, the electric current is not localized within the conductor. Current is the movement of co-currents, distributed to J through the plane \mathbf{y} is equal to the sum of all elementary currents: infinity. The

total current

$$J = \sum_{i=1}^N \mathbf{a}_i \quad (55)$$

Thus, in the presented concept the vector $//EM \mathbf{a}$ and is the current density vector.

Unlike current density \mathbf{j} Maxwell-Lorentz theory, which flows only within the conductor, in the presented concept the current flows in the entire space surrounding the conductor. The minus sign in (55) expresses the agreement that the positive direction of current is considered to be the movement of positive charges. Vector distribution law $//EM \mathbf{a}$

a \mathbf{v}

the space around the conductor is similar to the law of distribution of the vector potential \mathbf{A} in the Maxwell-Lorentz theory

$$\mathbf{a} \parallel \mathbf{A}_{EM} \quad (56)$$

Based on such a model of the magnetic field, in [3] an empirical Ampere's formula for the interaction of conductors with current.

7. Electron charge

Electric current is not a transfer of "electric matter", as modern physics believes, that is, the substantial theory of electromagnetism. **Electric current is a transfer of that part of the mass-energy of the vortex ring that does not obey the potential law.** This part is due to the circulation of surface forces. Thus, the essence of "electricity" is that part of the mechanical movement of the ring is not a potential movement. Such a transfer can occur in two ways:

1. Movement of cocurrent flows, i.e. vectors $\parallel \mathbf{EM} \mathbf{a}$;
2. Transfer of vortex rings – electrons (or ions), that is, vectors $\mathbf{a} \parallel$.

7.1 Mechanical equivalent of electricity

The explanation of electromagnetism by the mechanical motion of the ether poses the problem of finding a mechanical characteristic of motion that would replace the quantity that appears in substantial theories under the name of "charge e ". By analogy with the "mechanical equivalent of heat" established in the 19th century, this quantity can be called **mechanical equivalent of electricity**.

The presented theory allows us to obtain such an invariant of the ring motion. Let us consider the stationary motion of the ring with the velocity V_R (Fig. 3). According to (55), during such motion, a current $J\tilde{y}$ flows through the infinite plane \tilde{y} , normal to the translational velocity ,

the value of which is equal to the power of the flow of the vector $\mathbf{a} \parallel$:

$$J d\tilde{y} \parallel \tilde{y} \mathbf{a} \parallel \tilde{y} \tilde{y} \tilde{y} \tilde{y} \sqrt{1/2} \cdot \mathbf{v}_R \cdot \tilde{y} \quad (57)$$

The amount of flow of the vector $\mathbf{a} \parallel$ that has passed during time t , Let us denote this by the symbol \tilde{y} . This the value is equal to:

$$\tilde{y} \tilde{y} \int_0^t \tilde{y} dt \tilde{y} \sqrt{1/2} \cdot \mathbf{v}_R \cdot \tilde{y} d\tilde{y} \quad (58)$$

Using the value \tilde{y} the power of the flow of the vector $\mathbf{a} \parallel$ is as follows: will be written as follows

$$J t d\tilde{y} / \tilde{y} \tilde{y} \tilde{y} \tilde{y} \tilde{y} \sqrt{1/2} \cdot \mathbf{v}_R \cdot \tilde{y} \quad (59)$$

To calculate the total amount of flow of the vector $\mathbf{a} \parallel$ that has passed through the plane \tilde{y} , we must integrate (59) over time from \tilde{y} to $+\tilde{y}$. We will denote this amount as $\tilde{y} R$. This the value is equal to:

$$\tilde{y} \tilde{y} R \int_{\tilde{y}}^{\tilde{y}} \tilde{y} dt \sqrt{1/2} \cdot \mathbf{v}_R \cdot \tilde{y} d\tilde{y} \tilde{y} \sqrt{1/2} \cdot d\tilde{y} , \quad (60)$$

7.2. Equivalent model of the electron

Based on the obtained invariant $\ddot{y}R$, we construct an equivalent model of the “elementary electric charge”, i.e., the electron. According to (33), (35), the total field of the electron consists of the field of the vector a_0 and the field of the additional vector $a/\dot{}$. The equivalent model depicts

component a/\hbar , that is, it serves to describe the electromagnetic properties of the electron.

The existence of the invariant $\dot{\gamma}R$ means that the amount of flow of the vector $a//$ carried one ring during its movement, is a constant value. Based on this conclusion, the following equivalent model of the electron field can be created. The field of the vector $a//$, one ring (Fig. 3), can be replaced by a field created distributed in the volume of a circular cylinder (Fig. 9).

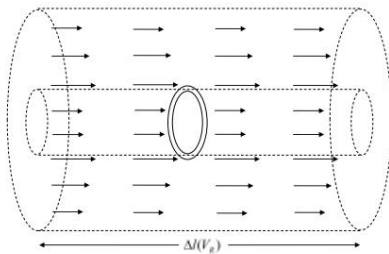


Fig. 9. Equivalent model of an electron, depicting the electromagnetic part of the vortex ring field in the ether

Power flow of vector a/ℓ in the cross section of the cylinder is constant and equal to the electron charge e . The length of the cylinder yl depends on the speed of the ring, but the total quantities

flows of the vector a / r , transferred by the cylinder and the vortex ring through the plane \tilde{y} are the same and equal to $\tilde{y}R$

$$\ddot{y}_R = \ddot{y} \sqrt{y/2} + v_R \ddot{y} \dot{y} \frac{1}{y} \int_{t_1}^{t_2} \ddot{y} dt + \text{const} \quad (64)$$

ratio, the value

yy y y In this

, so we will denote it by a special *ttt const 2 1*

symbol T_{eq} and call it “time equivalent”. This is the time during which the cylinder shown in Fig. 9 flows through the plane \ddot{y} :

$$/ \ddot{y} \ddot{y} \ddot{y} \ddot{y} VT_{R const} \quad \text{e.g.} \quad (65)$$

The value of Teq is a constant for all vortex rings – electrons. From (64) and (65) we get:

$$e T \ddot{y}_R / \quad (66)$$

7.3 Calculating \ddot{y}_R from experimental data

According to (66), the value of $\ddot{y}R$ can be calculated based on experimental data.

The magnitude of the charge e is known, it is necessary to determine the magnitude of Teg

To determine the value of T_{eq} , we consider the movement of electrons in a vacuum diode (Fig. 10). We consider a series current circuit consisting of a vacuum diode and

resistance R without . Let the electrons in the diode move one after another from the cathode K to the anode A gaps between the cylinders. Let the length () L VR of the diode such that an electron travels this distance in 1 second

$$L \sqrt{\frac{VR}{R}} s (67)$$

Let the number of electrons coming to the diode anode in 1 second be equal to 1 Coulomb. According to . length of the cylinder is: $\sqrt{\frac{VR}{R}} T (65)$, the Therefore, the number of cylinders that fit on the length L is equal to the number n of electrons in a charge of 1 Coulomb

$$T_{e.q.} = \frac{L \sqrt{\frac{VR}{R}} s}{V_R n} = \frac{R}{V_R} \frac{1}{n} \quad (68)$$

By definition, the ratio of the charge of an electron to the charge of 1 Coulomb is:

$$1/eC = 1.6 \cdot 10^{19} \quad 1/n$$

Substituting the value $1/n$ into (68), we obtain the time equivalent T_{eq} :

$$T_{e.q.} = 1 \frac{1}{n} = 1.6 \cdot 10^{19} s \quad (69)$$

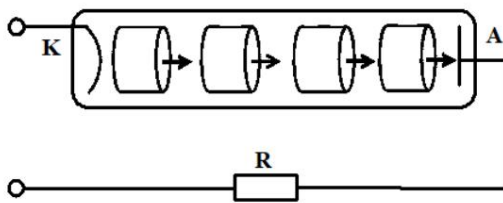


Fig. 10. Electron movement in a vacuum diode

This calculation does not use the quantities "1 Coulomb" or "electron charge", but only the ratio of these quantities.

Before making a theoretical calculation, let's consider what value \sqrt{R} is

should be obtained on the basis of the calculated value of T_{eq} . According to formula (66) we have:

$$\sqrt{R} = 4.8 \cdot 10^{10} (70) \quad \frac{19}{7.68 \cdot 10^{10} \text{ gm cm}} \quad \frac{29}{1/2} \quad \frac{3/2}{2}$$

This value is the "mechanical equivalent of electricity". It is a fundamental constant of the Universe and should replace the substantial value of "electron charge e ".

7.4 Brief description of the theoretical calculation of the invariant \sqrt{R}

In the work [3] calculations of the electron parameters are presented. These calculations are based on electron equation (42)

$$R_R = \frac{h}{m_e V_R}$$

All quantities included in (42) are known experimentally. But the model of an electron as a vortex ring in the ether makes it possible to theoretically calculate these quantities. We compile a system of equations to determine the parameters of an electron. There is a relation (12) for calculating the mass of an electron, and a relation (71) is also obtained for calculating the angular momentum of a medium rotating around the circular axis of a vortex. The third equation is the equation of the relationship between the circulation C , the radius of the core Or and the pressure in the ether $0 p$

(72)

$$m_e \frac{E}{cc} = \frac{1}{2} \frac{h}{m_e \lambda} \frac{d\lambda}{\lambda} \quad (14)$$

$$h = \frac{2\pi m_e \lambda^2}{h} \quad (71)$$

$$C_{rp} = \frac{h}{m_e \lambda} \quad (72)$$

From this system of three equations we determine three unknown quantities

$$C_{rp}, \lambda, \nu$$

Values are necessary to calculate the electron charge. The calculation was performed using the Mathcad program. Experimentally known values of quantities that must be calculated theoretically:

$h = 6.626 \cdot 10^{-34}$ J s – reduced Planck constant;

$e = 1.6 \cdot 10^{-19}$ C – electron charge;

$m_e = 9.109 \cdot 10^{-31}$ kg – mass of electron.

In [3] a charge calculation was made which differs from the experimentally known value at different points in the electron energy range by a factor of 10 at best. However, the charge calculation method used in [3] is not entirely reliable.

Another method for calculating the charge has been developed, based on the above concept of the mechanical equivalent of electricity. According to the elementary formula (66), to calculate the charge of an electron, it is necessary to determine the values of γR and T_{eq} .

To calculate the value of γR , the integral (60) must be calculated. The calculation was performed using the Mathcad program using the same method that was used in [3] to calculate the electron parameters. Let us briefly consider this method.

Since the vortex ring is a three-dimensional flow with an axis of symmetry, two coordinates, rather than three, are required to describe the field. Consequently, we can introduce the current function

ψ . Choosing a cylindrical coordinate system (r, z) , so that the z-axis

parallel to the axis of symmetry of the ring, one can obtain an expression for the current function $\psi(r, z)$ [14, p. 6, p. 300]

$$\psi = \frac{C}{2\pi} \int_0^{2\pi} \int_0^{\infty} \frac{R(r')}{\sqrt{(r-r')^2 + z^2}} r' dr' dz, \quad (73)$$

where: C – circulation;

$R(r, z)$ – the distance from the point under consideration to the axis

vortex:

$R_2(r, z)$ – the distance from the point to the vortex axis:

$$\psi(r, z) = \frac{R_1(r, z) - R_2(r, z)}{2\pi} \quad (74)$$

$$\psi(r, z) = \arcsin \left(\frac{R_1(r, z) - R_2(r, z)}{2\pi} \right) \quad (75)$$

$$F(\phi, k) = \int_0^{\phi} \frac{1}{\sqrt{1 - k^2 \sin^2 \theta}} d\theta \quad \text{– complete elliptic integral of the first kind}$$

$$Erz(\gamma) = \int_0^{\gamma/2} \sqrt{1 - \sin^2(\gamma) \sin^2 \varphi} d\varphi - \text{complete elliptic integral of the 2nd kind}$$

$$a_z = \frac{1}{r} \frac{\partial \psi}{\partial z} - \text{component of vector } \mathbf{a} \text{ along the } z \text{ axis}; \quad (74)$$

$$a_r = \frac{1}{r} \frac{\partial \psi}{\partial r} - \text{the component of the vector } \mathbf{a} \text{ along the } r \text{ axis}. \quad (75)$$

Based on relations (74) and (75) for the components of the vector \mathbf{a} , we obtain an expression for integral (60). Using (9), this integral takes the form

$$\psi_{R,zr} = \int_0^{10^{-4} \text{ mm}} \int_0^{10^{-1} \text{ m}} \frac{2\gamma}{c\sqrt{2}} \left| \frac{\partial \psi}{\partial r} \frac{\partial \psi}{\partial z} \right|^{1/2} dr dz \quad (76)$$

The calculation algorithm is entered into the Mathcad program. To calculate the charge, we use the calculation data for the electron parameters given in [3]. The calculation is possible only in

a certain range of vortex ring radii $R_R = (10^{-12} \text{ to } 3 \cdot 10^{-11}) \text{ m}$. Beyond this range, the calculated parameter values exceed the permissible limits and tend to infinity. This issue will be discussed below.

The specified range is divided into several points, in which the parameter values are calculated. The calculation results are summarized in the Table.

Table. Calculation of the charge of an electron

$R_R(\text{cm})$	$V_R(\text{cm/s})$	$C(g^{1/2} \text{cm}^{1/2}/\text{s})$	$r_0(\text{cm})$	$p_0(\text{barye})$	$\Xi_R(g^{1/2} \text{cm}^{3/2})$	$e(\text{esu})$
10^{-10}	$1.15 \cdot 10^{10}$	51,86	$5.0 \cdot 10^{-12}$	$2,72 \cdot 10^{24}$	$1,957 \cdot 10^{-28}$	$1.22 \cdot 10^{-9}$
$2 \cdot 10^{-10}$	$5.75 \cdot 10^9$	25,045	$3.11 \cdot 10^{-13}$	$1,64 \cdot 10^{26}$	$3,759 \cdot 10^{-28}$	$2.35 \cdot 10^{-9}$
$3 \cdot 10^{-10}$	$3.85 \cdot 10^9$	15,305	$2.71 \cdot 10^{-15}$	$8,07 \cdot 10^{29}$	$5,166 \cdot 10^{-28}$	$3.23 \cdot 10^{-9}$
$4 \cdot 10^{-10}$	$2.88 \cdot 10^9$	11,308	$4,67 \cdot 10^{-17}$	$1,485 \cdot 10^{33}$	$6,785 \cdot 10^{-28}$	$4.24 \cdot 10^{-9}$
$5 \cdot 10^{-10}$	$2.3 \cdot 10^9$	8,981	$7.91 \cdot 10^{-19}$	$3,26 \cdot 10^{36}$	$8,418 \cdot 10^{-28}$	$5.26 \cdot 10^{-9}$
$6 \cdot 10^{-10}$	$1.92 \cdot 10^9$	7,431	$1.16 \cdot 10^{-20}$	$1,04 \cdot 10^{40}$	$1,003 \cdot 10^{-27}$	$6.27 \cdot 10^{-9}$
$7 \cdot 10^{-10}$	$1.65 \cdot 10^9$	6,235	$1.43 \cdot 10^{-22}$	$4,8 \cdot 10^{43}$	$1,162 \cdot 10^{-27}$	$7.26 \cdot 10^{-9}$
$8 \cdot 10^{-10}$	$1.44 \cdot 10^9$	5,534	$2,59 \cdot 10^{-24}$	$1,16 \cdot 10^{47}$	$1,328 \cdot 10^{-27}$	$8.3 \cdot 10^{-9}$
$9 \cdot 10^{-10}$	$1.28 \cdot 10^9$	4,902	$3.24 \cdot 10^{-26}$	$5,8 \cdot 10^{50}$	$1,488 \cdot 10^{-27}$	$9.3 \cdot 10^{-9}$
10^{-9}	$1.15 \cdot 10^9$	4,396	$4.00 \cdot 10^{-28}$	$3,06 \cdot 10^{54}$	$1,516 \cdot 10^{-27}$	$9.48 \cdot 10^{-9}$

As can be seen from the table, the best result is obtained at the point $R_R = 10^{-12} \text{ m}$. Here the calculated value of the charge differs from the experimentally known value by a factor of 2.54. As the radius of the ring increases, the discrepancy increases to 20 times. The reasons for the discrepancy are analyzed in [3]. The main reason is apparently the fact that the field of the ring is calculated using formulas for the medium of the Euler model. In reality, the ether has

property of superfluidity, therefore there are differences in the fields. However, there are no methods for calculating fields in the ether yet. Therefore, the calculation performed cannot be called a full-fledged calculation (this is a task for the future), but only an estimate of the charge value. Although the exact value of the charge has not yet been calculated, but taking into account the absolute novelty of the problem and technical difficulties, these results can be considered satisfactory. This assessment shows that the proposed picture of the phenomena is possible. The main goal of this work is to clarify the mechanical structure of the Universe and explain the Michelson experiment from this position.

Conclusion

At present, the main obstacle to the creation of a rational physical science is the theory of relativity. Let us consider the place of RT in the system of knowledge about Nature. RT is clearly not an ideal theory: it contains esoteric 4-dimensional pseudo-Euclidean spaces, moreover, in GR, they are curved. That is, to explain the phenomena of Nature, RT uses supernatural concepts that cannot be logically understood. For this reason, and also because SR excluded ether from the Universe, it is subject to criticism. But the facts are stubborn and merciless: the dynamics of SR are correct. Relativists claim that SR is a revolutionary change in the fundamental concepts of Newtonian mechanics. It is believed that SR is the ABC of physics, which only ignoramuses and madmen can doubt. Under the sign of such statements, any articles criticizing SR are blocked.

Yes, the dynamics of STR is correct, since the trajectories of electrons in accelerators coincide with the calculations performed using the dynamics of STR. But this does not mean that the entire STR is correct. The kinematics of STR, that is, the Lorentz formulas, is a superficial, esoteric hypothesis. In the presented concept, the formulas of dynamics are proven without the Lorentz formulas, based on the concept of ether. Therefore, STR is not a fundamental theory at all, but a palliative theory of the patch type, created to hide the flaws of Newton's theory. The fundamental revision of Newton is presented in the proposed concept.

From the standpoint of this concept, STR should be considered not as a scientific, but as an engineering theory that played a positive role in nuclear energy, accelerator design, and for military purposes. In the scientific aspect, STR had a sharply negative impact, destroying the eternal desire for clarity in science. The ideas presented in these works show that 20th century physics does not represent the true structure of the Universe, but approximate methods of description. The Universe is arranged, that is, simply and mathematically strictly, without any approximating assumptions. Experiments, for the solution of which STR and quantum mechanics were created, from the standpoint **perfect**, of the presented theory can be described as mechanical movements of ether. The description of these movements is made rationally, without esoteric concepts of "four-dimensional pseudo-Euclidean space-time" or "probabilistic description of particle behavior." That is, the proposed theory simplifies physical concepts and their mathematical description. The simplification occurs because the ether represents a simpler form of matter motion compared to ideal media described on the basis of Newtonian physics. In contrast to 20th century physics, which builds its concepts on the basis of the complication of classical physics, the proposed theory states that when delving deeper into the structure of matter, the equations must be simplified. The ether equation is simpler than the Euler equation 386

ideal environment. The explanation of Michelson's result is simpler than that of STR. The description of the structure of the electron is simpler than that given by quantum mechanics. According to Occam's razor, the correct theory is the simplest theory.

In physics, there should be no quantities that do not have a mechanical interpretation. One of such deep substantial concepts is the quantity "time". Although the concept of time is one of the most ancient concepts, it is not a scientific, but a purely everyday concept. The concept of "time" is in some ways similar to the concept of "caloric". The study of phenomena based on the existence of caloric was mathematically quite simple; the idea that heat is caused by the chaotic movement of particles is more complex. However, when scientists came to understand the mechanical essence of heat, the scientific community realized that recognizing the existence of caloric is "primitive substantialism". The author is convinced that a similar fate awaits the concept

"time".

Acknowledgments

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The mechanical structure of the Universe

Mechanical equivalent of electricity

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The work is a development of the concept outlined in the monograph "Mathematical foundations of Ether Mechanics". After the creation of SRT, physics abandoned the concept of the world medium. The further development of physics in the 20th century is only a mathematical description of experiments, without building mechanical models. The monograph outlines the basics of the new mechanics of the world medium. The solution is deeper philosophically, but mathematically simpler. Newton's physics is not mechanics, since it has substantial quantities of mass and time. The main provisions of the theory are briefly outlined, a rational explanation of the Michelson experiment is presented, and the concept of "mechanical equivalent of electricity" is introduced

What is a de Broglie wave

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The de Broglie wave is a vortex of the electromagnetic field environment attached to a neutrino. When neutrinos combine into particles and bodies, the de Broglie waves of individual neutrinos come out, forming a de Broglie vortex. The mass of the vortex is the relativistic mass of the composite particle or body. The intensity of the de Broglie vortex decreases with distance from the boundary of the particle or body. According to the Bernoulli effect, the gradient of the normal pressure of the external environment of the electromagnetic field in the volume of the vortex creates a gravitational force. Maxwell's equation describes this process. We call the de Broglie vortices of planets and stars a gravitational field.

Terms and definitions

Matter is a substance of three nested phases that fill the Universe: primordial matter, electromagnetic field and matter.

The electromagnetic field is a phase state of matter in the form of an invisible dispersed medium that fills all space. The smallest particles of the electromagnetic field medium are *gravitons* – move continuously at the speed of light. It is necessary to distinguish between the concept of the field environment as a whole and specific manifestations of this environment in the form of *flows* and *disturbances*. Rectilinear flows of gravitons are usually called flows of *vector potential*. Vortex flows of gravitons form a *magnetic* field. We consider the translational motion of gravitons in the form of rapidly rotating thin fibers as an *electric* field. Diverging vortex flows are known as *transverse radio waves*. White noise of the field environment is registered as *microwave background radiation*. Longitudinal waves in the environment, arising as a result of accelerations and shock disturbances of space objects, are called *gravitational waves*. We are convinced of the existence of the electromagnetic field as a global environment every time we bring a mobile phone to our ear.

The speed of light is the value of the thermal speed of gravitons.

Substance is a phase state of matter in the form of vortex condensations of the electromagnetic field, forming the smallest particles of matter - *neutrinos and antineutrinos*.

An electron is a particle of matter made up of paired neutrinos.

Mass is the number (in kg) of gravitons in a material body.

Electromagnetic (relativistic) mass is the number of gravitons in the boundary layer electromagnetic field environment attached to a material body.

Electric charge - rotating beams of gravitons emitted by particles electromagnetic field.

What de Broglie proposed

In 1924, Louis de Broglie presented the concept of corpuscular-wave duality in his doctoral dissertation using the electron as an example. He considered the electron spin $\hbar/2$ as the angular momentum of the electron mass m_0 rotating at the speed of light c along a circle of radius r_e (Compton wave radius for an electron) [1]:

Rotation is the main type of motion in the microworld. Only through rotation can a large amount of energy be stored in a small volume. Particles rotate to avoid merging under the action of gravity. We perceive the kinetic energy of their rotation as potential "*rest energy*". Therefore, de Broglie proposed to determine the angular frequency of rotation $\ddot{\gamma}$ in the particle's frame of reference from the formula:

(1)

This internal periodic process serves as a measure of the electron's *proper time*. When moving to another frame of reference, relation (1) is violated, since it is not invariant. For a particle moving with velocity V , the mass increases (

the frequency of the clock decreases (loses force), $\gamma = V/c$. Thus, the relation (1)

To make relation (1) relativistic, de Broglie introduces a process in the space surrounding the particle. The rotation of the particle entrains the boundary layer of the electromagnetic field medium into rotation with the same frequency. De Broglie called this layer a *stationary wave (pilot wave)*. The rotation of the vortex of the medium in the reference frame of the stationary particle can be described by the wave function for the oscillatory process:

(2)

In the laboratory coordinate system for a particle moving with velocity V , time is transformed into t : ($\gamma = V/c$). Here t is the phase

displacement time, x is the phase coordinate of the wave in the direction of its motion. The wave function (2) will now describe a stationary wave:

(3)

Stationary wave frequency $\gamma =$ increases at a rate V proportionally

growth of the relativistic mass $m =$ particles of the medium in the de Broglie wave:

or

The wave function (3) of the de Broglie wave can then be rewritten as an expression for a plane wave:

γ

The wave parameters are directly determined from this expression:

- $u = c^2/V$ is the phase velocity of the de Broglie wave;
- $p = mV$ — wave momentum;
- $\gamma = h/p$ — wavelength.

These quantities are relativistic, i.e. invariant. They are related by the equation

De Broglie considered not a particle-wave, but a particle and a wave attached to it in a medium as independent, although dependent, entities. He formulated the law of phase correspondence: "A moving electron is always in phase with its stationary wave." Indeed, the phase that a particle acquires during movement over time t is equal to:

This value coincides with the value of the wave phase at the point where the particle is located at $x = Vt$:

The equality of the phases of the electron and the wave is a consequence of the fact that the particle generates and by its own Supports the wave by rotating.

The above formulas describe the de Broglie wave as a vortex of the medium, as if sticking to a rotating particle. The mass of the vortex is relativistic, the rotation frequencies and phases of the particle and wave coincide. At $V = c$ (which is true for neutrinos and photons), the speed of the de Broglie wave is $u = c$. In 1934, de Broglie presented the idea of the "neutrino theory of light" [2]. He suggested that a photon consists of two half-photons - two neutrinos, so that the "de Broglie vortex" of the photon consists of neutrino waves.

A de Broglie wave is a vortex attached to a neutrino in an electromagnetic field.

De Broglie's idea of wave-particle duality was the basis of quantum (wave) mechanics. The de Broglie wavelength for a particle is the ratio $m -$ the relativistic mass of the particle, and $V -$ the velocity of the particle. Then the phase velocity of the de Broglie wave $u = c^2 / V$ exceeds the speed of light. Therefore, the de Broglie wave is considered not a material wave, but a probability wave of the particle being at a given point in space. To resolve these contradictions and better understand the nature of de Broglie waves, it is necessary to construct a visual physical model of the particle.

The de Broglie wave creates the movement of neutrinos

It has been experimentally established that in the world around us there are three types of matter, differing in their properties. These types are three phase states of matter: *primordial matter (dark energy)*, *electromagnetic field (dark matter)*, *substance* [3]. Figure 1 on the left shows a diagram of the nested phases of matter in our Universe.

Space is filled with *the electromagnetic field medium*. The smallest vortex particles of the medium – *gravitons* – continuously move at the speed of light. Electric and magnetic fields represent the translational and rotational flows of this medium.



Fig. 1. Scheme of nested phases of matter and the appearance of neutrinos and antineutrinos

In the electromagnetic field environment inside stars, a multitude of closed vortices are formed, forming a third nested environment - *matter*. The smallest vortex particles of matter are *neutrinos* (spin $-1/2$) and *antineutrinos* (spin $1/2$) are toroidal vortex condensations of *the electromagnetic field* medium (Figure 1 on the right). Neutrino rotation can be divided into ring and toroidal. Neutrinos rotate as left-handed vortices, and antineutrinos as right-handed vortices.

The de Broglie wave follows the neutrino core. The ring wave creates a magnetic moment of the neutrino. The toroidal wave ensures the movement of the neutrino due to the support of the outer layer of the electromagnetic field medium (Figure 2 on the left). There is no friction in the microworld. Friction is the transfer of energy. But the gravitons of the medium already have the maximum permissible energy - their thermal speed is equal to the speed of light. Therefore, neutrinos continuously move in the graviton medium at the speed of light [4].

The intensity of the de Broglie wave (the tangential rotating boundary flow of the medium) decreases with distance from the neutrino. In accordance with the Bernoulli effect, this creates a gradient of the normal pressure of the external medium of the electromagnetic field - *the gravitational force* in the volume of the de Broglie wave. The gravitational force causes neutrinos to pair with each other and with other particles.

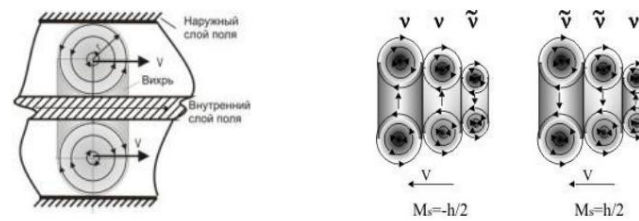


Fig. 2. Scheme of the motion of a neutrino vortex in a medium and a muon neutrino

The idea that neutrinos are inert is a myth. Electron neutrinos and antineutrinos are the only elementary particles. All other particles are composite. They are composed of electron neutrinos and antineutrinos. As an example, Figure 2 on the right shows a diagram of a *muon neutrino* and a *muon antineutrino*.

De Broglie waves transmit the momentum of photons and antiphotons

Photons are assembled (Figure 3 left) from two neutrinos (*left-handed photons*) or from two antineutrinos (*right-handed photons* or *antiphotons*). The direction of rotation determines the *polarization* of the light. Neutrinos are coaxially located one behind the other and repel *each other* pressure of the external environment in accordance with the Bernoulli effect.

A photon is a particle-wave with an internal periodic process. Neutrinos constantly change places, changing their sizes, and passing through each other according to the principle of the "game of vortex rings" (Figure 3 on the right). The speed of the center of mass of each neutrino changes sinusoidally during the translational motion of the photon. The front ring acts with its de Broglie wave flow on the back ring in such a way (see the extension lines of Figure 3 on the left) that the center of mass of the back vortex shifts to the axis and forward. But then the proper flow of toroidal rotation makes the back ring decrease its diameter and accelerate. Similarly, the back ring (see the extension line of the middle Figure 3 on the left) slows down and increases the diameter of the front ring. When the back ring passes through the hole in the front ring, it will become the front one, and the whole picture will repeat.

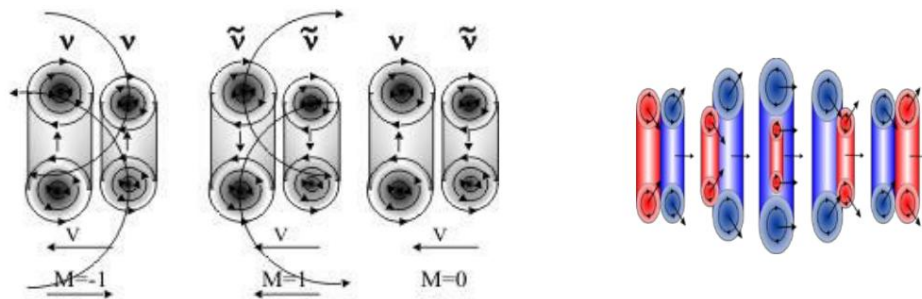


Fig. 3. Structural diagram of photons and the play of vortex rings

The wave-corpuscular duality of the photon-wave consists of a periodic change parameters of the internal motion of the constituent neutrinos.

The third variant of a photon is shown on the left in Figure 3 — a combination of a neutrino and an antineutrino. This boson particle cannot be observed, although it can exist, moving at the speed of light. Such "*dark photons*" can only have their own energy, which cannot be taken away. The moments of the ring rotations compensate each other here. A dark photon cannot transfer its momentum to the recording device, it is inaccessible to observation, it cannot be recorded. Therefore, the number of possible observable orientations of the photon spin is two, and not three, which a particle with spin $S=1$ would have ($2S+1=3$).

Each photon has energy, momentum, angular momentum, rotation frequency $\dot{\gamma}$ of the rings as a whole and the frequency of the "ring game". *Toroidal rotation* provides photons in "thermal" equilibrium with the environment with a constant translational speed (speed of light) *regardless of the source speed*. The speed c depends on the permittivity and magnetic permeability of the medium:

$$c = \frac{1}{\sqrt{\epsilon \mu}}$$

The frequency of *the ring rotation* of the rings $\dot{\gamma}$ is not related to the photon's own internal properties. Due to the ring rotation, photons can transfer momentum between objects of the microworld. The exchange of energy between atoms occurs through the change in their momentum by photons of the environment. Photons pass through the neutrino of electrons and receive or give up momentum according to the principle of "from hot to cold" (Figure 4 on the left).

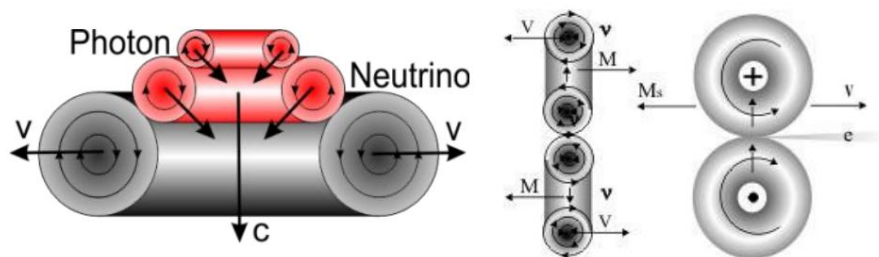


Fig. 4. Transfer of momentum from photon to neutrino and electron diagram

In Planck's formula $E = h\nu$ it is the frequency of the ring rotation that is involved. It determines much (~1000 times) color of light. Energy of toroidal rotation of ring rotation. more than the frequency
Therefore, formula (1) in de Broglie's proposals is incorrect.

De Broglie waves create the charge and magnetic moment of the electron

Electrons and positrons are particles supersymmetric to photons and antiphotons. Experimental evidence is provided by the annihilation reaction.

The electron is made up of two neutrino vortices with oppositely directed velocities (Figure 4 on the right). Neutrinos are attracted to each other by the vortex interaction mechanism. They rotate at the speed of light in a circular orbit around a common point in a plane perpendicular to the plane of the rings. The neutrino moments are opposite. *The new vortex* formed during the rotation of the "eight" has a spin -

the proper moment of an electron $\dot{\gamma} R_s R = h/2$ [4].

Let us consider this model in another plane (see the right part of the figure). Unlike the neutrino and photon, here the ring flow, not the toroidal flow, is the particle's mover. The toroidal flow will determine the "latent energy". In Figure 4, the electron moves to the right - in the direction opposite to the direction of the spin $M R_s R$. The speed of translational motion is proportional to the frequency of the ring rotation.

It is easy to see that the neutrinos rotating in the electron form a kind of "gear pump". Neutrinos tightly compress the central part of the near-surface layer of the field, pushing out a stream of entrained gravitons into the solid angle in the direction of the velocity v . An open *vortex tube* is formed along the axis of the particles, rotating around its axis with the frequency of toroidal rotation.

Here we use the term "tube" not in the sense of describing geometry, but in the sense of a *Faraday charge tube*. The charge vortex chamber is an *outgoing rotating beam flow of gravitons*. The rotation of the vortex tube for an electron forms a left screw, and for a positron - a right screw with the direction of the flow. We identify the screw flow of gravitons in the vortex tube with its own *gradient electric field Egr*.

The flow rate (kg/s) determines the electron *charge* e . Formally, at the beginning of the charge 393

The positron has a source in the tube, and the electron has a drain. Therefore, the charge of the positron is called *positive*, and the charge of the electron is *negative* [5].

In Figure 5, the de Broglie waves of the neutrino are shown in halftone on the left. The toroidal rotation of the neutrino causes them to rotate around the electron axis. The de Broglie waves carried away by this rotation form the electron *magnetic moment*. The ring rotations of the neutrino occur with a lower frequency. The de Broglie waves carried away by this rotation form *the electron charge*. The field flux is generated at point a. Together with the neutrino, the de Broglie wave rotates around the electron axis along the path abcd. Then the flux is ejected along the electron axis in the form of a narrow rotating beam along the straight line ae. The translational velocity of the graviton flux in the beam (electric field) is significantly less than the speed of light. The mass of the boundary layer of the field around each neutrino (in the de Broglie wave) is equal to the relativistic mass of the neutrino. Consequently, the mass of the emitted beam flux during one neutrino revolution is equal to the relativistic mass of the electron.

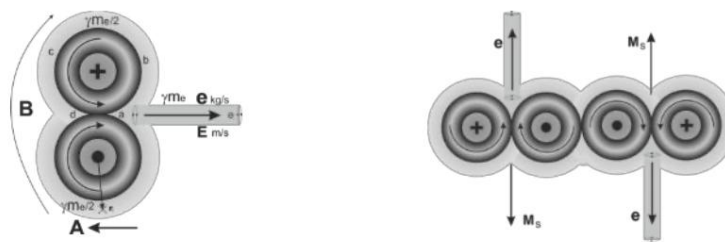


Fig. 5. Scheme of de Broglie waves of electron and Cooper pair

De Broglie waves (Figure 5 on the left) determine all the parameters of the electron. We identify *the translational motion of the vortex* with the flow of vector potential **A**. *The rotational motion of the vortex* determines *the magnetic moment* of the electron (magnetic induction **B**). In Maxwell's equations, **divA = 0 is usually assumed**. Here, this means that the magnetic fluxes along the path *abcd* and the electric fluxes along the path *ae* are independent. It is assumed that the flux of the field *abcd* closes around the neutrino at the point of origin *a*. In macrobodies, magnetic fields are carried outward, creating an "aura" around the body. The gradient part of the vector potential **A** (the outgoing flow *ae*) is considered a *scalar potential*: $\text{grad}\vec{A} = \vec{E}$.

In superconductivity, when the temperature is close to absolute zero, electrons combine into *Cooper pairs*. (Figure 5 on the right). Counter-moving ring vortices of neutrinos with the same direction of rotation attract each other. The result is a composite particle-boson with zero spin and a charge of $2e$. The electrons in the pair rotate around a common point, forming a new vortex. An increase in temperature destroys these structures.

The considered structure of the electron reveals new properties of the electrostatic field. The electric field is quantized, it has a fibrous structure and has a torque. A quantum of the electrostatic field is a separate fiber emanating from a charged particle - an electron or a proton. Each fiber is a vortex tube in the form of a narrow rotating flow of gravitons. Electrons create left-handed flows, and protons - right-handed flows of gravitons. Figure 6 on the left schematically shows a section of the electrostatic field of a section of a negatively charged plate. The flows of gravitons in neighboring fibers between the centers of the fibers are directed towards each other. Therefore, their rotational action inside the flow is mutually compensated.

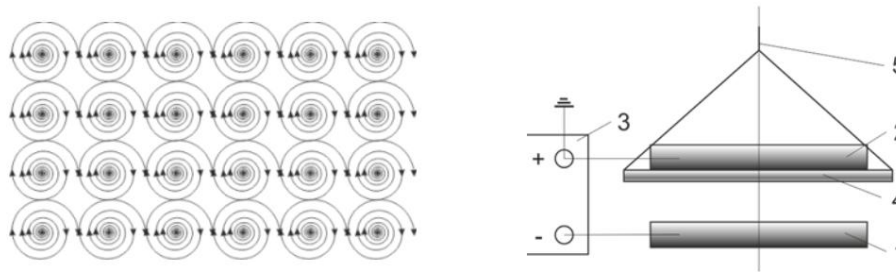


Fig. 6. Fiber structure of the electrostatic field and the experimental scheme

The presence of torque in an electrostatic field can be easily verified by a simple experiment. The experimental setup is shown in Figure 6 on the right. The setup contains two disk electrodes 1 and 2 with a diameter of 100 mm, installed coaxially one above the other at a distance of 30 mm. The stationary lower electrode 1 is connected to the negative pole of the power source 3. The upper electrode 2 is installed on a polyethylene disk 4 and is connected to the grounded positive pole of the power source 3. The disk 4 is suspended on a thread 5 with a length of 1.5 m and can rotate freely.

When a negative potential of up to 10 kV is applied to electrode 1, the upper electrode 2 rotates together with disk 4 clockwise (if viewed from above) at an angle of up to 90° . The reason for the rotation is the vortex (left-handed) flows of gravitons from the upper surface of electrode 1.

Thus, the charge and magnetic moment of the electron are the parameters of its shell - de Broglie waves. The particle itself plays the role of the mover of the entire inseparable system of matter and field. What we perceive as the potential energy of the electrostatic field and magnetic field, in a wider system is the kinetic energy of the invisible to us translational and rotational flows of gravitons. Let us consider these processes in a little more detail.

It can be assumed approximately that the mass of the de Broglie wave is equal to the mass of the core. In other words, during one revolution of the neutrino ring rotation, the entire mass of the attached layer m_e is ejected into the charge tube, and during one second, the mass e . The specific charge of the electron $\bar{m} = 1.76 \cdot 10^{11} \text{ P} (\text{cP}^{-1} \text{ P})$ determines the proper (minimum) number of revolutions of the annular rotation in one second. The proper energy of the annular rotation $E_{ro} = 2\gamma h \bar{m} = 1.161 \cdot 10^{22} \text{ P J} = 7.253 \cdot 10^4 \text{ P eV}$.

For comparison, the self-energy of toroidal rotation is

$$E_o = m_e c^2 = 8.187 \cdot 10^{-14} \text{ PJ} = 5.117 \cdot 10^5 \text{ PeV} = 0.511 \text{ MeV}.$$

In the ground state, at zero translational velocity, the electron creates a magnetic field, which corresponds to the electron's own (spin) magnetic moment \bar{m} . Its value practically coincides with the Bohr magneton \bar{m}_B — the product of the spin $\hbar/2$ and the specific charge e/m :

$$\bar{m} = 9.274 \cdot 10^{-24} \text{ P (J/T)}.$$

The electron spin, equal to $\hbar/2$, takes into account the rotation energy of two neutrinos around its axis *only on one revolution*. The electron spin is the angular momentum, the moment of mass flow:

$$\hbar/2 = m_e c r_n = 0.527 \times 10^{-34} \text{ P (J x s)}.$$

Hence, the radius of the neutrino in the electron is

$r_n = 1.930 \times 10^{-13} \text{ m}$. The magnetic moment is equal to the energy of rotation of the de Broglie waves around the electron axis per second ($[J = \text{kg x m}^2 \text{ P x s}^{-2} \text{ P}]$). But the mass of both de Broglie waves per second is equal to the charge e . Therefore, the magnetic moment is the moment of the charge flux e relative to the average radius of the attached layer r_{R1R} :

From here, using the known value $\gamma_s = 9.285 \cdot 10^{-24} \text{ J/T}$, we find $r_{R1R} \approx 1.934 \cdot 10^{-13} \text{ m}$. The deviation of the value of the electron magnetic moment from the value of the Bohr magneton is explained by the discrepancy between the centers of mass of the neutrino and the de Broglie wave.

An electron is a wave particle with an internal periodic process. The centers of mass of neutrinos simultaneously with the translational motion rotate around the electron axis, i.e. around the direction of motion. If we imagine an electron as two point masses of neutrinos m_{RnR} , then these masses will move in a spiral. Projections of the spiral trajectories of neutrinos on a plane passing through the axis are shown in Figure 7. The trajectories differ in phase by 180° .

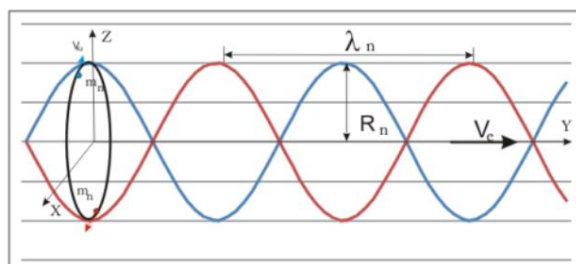


Fig. 7. Projections of neutrino spiral trajectories in an electron

The spiral motion of the neutrino's centers of mass reflects the wave representation of the electron. In this representation, the following wave characteristics can be distinguished:

- γ_{RnR} is the wavelength equal to the helix pitch;
- v_e is the velocity of the electron along the axis;
- γ_{RRnR} is the amplitude equal to the neutrino radius;
- $\gamma_{\gamma_{RnR}}$ — the frequency of neutrino revolution around the axis of the spiral OY;
- the phase of the neutrino at a given moment in time;
- polarization, i.e. the direction of rotation relative to the OY axis.

The figure on the left shows the projection of the helix on the XZ plane. Spin $\hbar/2$ along the Y axis is created due to the uniform rotation of two neutrino masses m_{RnR} around a circle of radius R_{RnR} at a speed v . If we calculate according to classical formulas, then for the assessment we can

put $\gamma_{RnR} = \frac{h}{m_{RnR} v}$. From here we obtain an expression for the radius of the neutrino, assuming $\gamma_{RnR} = \frac{h}{m_{RnR} v}$ m.

The translational velocity of the electron v_e is determined by the frequency γ_{RnR} of the ring rotation of the neutrino around its axis. In this case, the centers of mass of both neutrinos move along the electron axis along a sinusoid, representing a local wave. The wave characteristics are related to each other by the relation. The connection between the corpuscular and wave representations is realized through $\gamma_{RnR} = \frac{h}{m_{RnR} v}$.

expressions for the particle energy. For low velocities, the kinetic energy of a free electron is expressed by the formula. The energy of a quantum with moment $\hbar/2$ is given by Planck's formula. From these formulas we obtain expressions for the wavelength:

$$\gamma_{RnR} = \frac{h}{m_{RnR} v}, \quad \gamma_{\gamma_{RnR}} = \frac{h}{m_{RnR} v^2}$$

—, which coincides with the formula de Broglie. The corpuscular-wave duality of the electron-wave consists of a periodic change in the parameters of the internal motion of the constituent neutrinos.

The de Broglie wave determines the relativistic mass of a body

"Body mass" and "relativistic body mass" - these concepts refer to different objects: to the body itself and to its field shell, i.e. to de Broglie waves. We define the body mass m according to Newton, who claimed that matter is built from elementary particles of the same nature and density. Therefore, mass is *a measure of the amount of matter (or more precisely, gravitons)*, proportional to its density and volume. The number of gravitons in a body determines its inertia, weight and gravitational effect on other bodies. Mass in Newton as a property of primary matter is static, divorced from movement.

Relativistic mass \tilde{m} is defined as *a measure of inertia* and *a measure of gravity* of a body. Inertia of mass is manifested in the fact that the body changes the value of its momentum only under the action of an external force. Inertia is measured by the ratio of force to acceleration. If the velocity of the body during acceleration is directed along the z axis, then the x , y , z components of inertia will be equal to \tilde{y}_{io} , \tilde{y}_{io} , i_o — longitudinal $\tilde{y}^3 i_o$, where i_o is the static inertia, \tilde{y}_{io} is the transverse inertia, \tilde{y} inertia, and $\tilde{y}^3 i_o$.

The significance of m and \tilde{m} for a moving body can be better understood by considering the following equations expressing its main mechanical properties [6]:

	Energy
$\tilde{m} c^2$	Acceleration of free fall during the motion of an active gravitational mass
$\tilde{m} a$	Inertia at arbitrary direction of velocity
$\tilde{m} \frac{d\mathbf{v}}{dt}$	Rate of change of momentum in a gravitational field during the motion of a passive gravitational mass
$\tilde{m} \mathbf{v}$	Pulse

The following notations are introduced here:

\mathbf{v} , \mathbf{a} , \mathbf{F} — unit dyadic tensor,

G is the gravitational constant, M is the active gravitational mass.

All mechanical quantities given in the table are directly proportional to the relativistic mass \tilde{m} , i.e. the number of gravitons in the de Broglie vortex. External bodies and fields interact not with the particle itself, but with its de Broglie wave. Let us consider, as an example, the interaction of active and passive gravitational masses (Figure 8 on the left).

The active gravitational mass 1 creates a de Broglie vortex around itself — its own vortex flows 2. We call the region 3 occupied by the flows *the gravitational field*. The intensity of the vortex flows decreases with radius. Therefore, a radial pressure gradient of the external environment arises in the gravitational field (in accordance with the Bernoulli effect). The density of the field medium remains constant throughout the volume.

The passive gravitational mass 4 is also surrounded by a de Broglie vortex 5 of the proper vortex flows of the field 6. For a mass of 1 kg, the radius of the vortex 5 will be 3 km. The radial pressure of the external environment of the field on the volume of the vortex 5 will be different at its boundaries. Therefore, the entire volume 5 containing the passive mass 4 is "pushed" by the external environment toward lower pressures, i.e., into the center of the proper field 3 of the active mass 1. The buoyant force F acts on the de Broglie vortex 5 from the external environment - similar to how air bubbles are pushed upward from water by the Archimedes force.

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meanings

_____ Note that the expression _____ similar to the expression . Therefore we can talk about a "relativistic" increase in the charge of particles.

Thus, the charge of an electron is a dynamic concept related to its de Broglie wave, not to the particle core. *The charge of an electron is a rotating beam of gravitons emanating from the electron.*

De Broglie waves create a gravitational field of the body

Matter is in perpetual motion. Particles push each other away when moving. Repulsive forces are primary. Gravity is a normal mechanical force created by the pressure gradient of the environment. Repulsive forces, not attractive forces, create gravity. Let us consider this phenomenon in more detail using the Earth as an example.

The Earth is made up of neutrinos. The electromagnetic mass from each neutrino is carried out of the Earth. The electromagnetic mass of the Earth is equal to *the electromagnetic mass* from all the neutrinos (excluding their eigenvalues) that make up the Earth. Figuratively speaking, there are two Earth masses: one is the solid planet we live on, and the other is the de Broglie field vortex, the Earth's own vortex gravitational field.

We can estimate the minimum radius of the de Broglie vortex around the Earth if we assume that the electromagnetic mass of the Earth is equal to $M=6 \cdot 10^{24}$ kg, and the density of the electromagnetic field medium is equal to $\rho = 8.85 \cdot 10^{-12}$ kg/m³ :

$$M = \frac{4}{3} \cdot \rho \cdot R^3 = 4.2 R^3$$

$$R \approx 1.12 \cdot 10^8 \text{ km}$$

The vortex field shell of the Earth reaches the orbits of Venus and Mars.

Gravitational force as a pressure gradient arises either in the vortices of the medium itself or in the vortices that exist around stars, planets and all other bodies in accordance with Bernoulli's law (Figure 9, left). In Bernoulli's experiment, the pressure in the middle tube is less by the value of the dynamic pressure of the transverse flow.

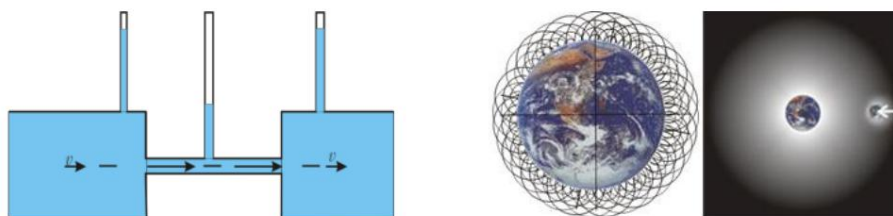


Fig. 9. Bernoulli's experiment (left) and the Earth and the Moon (right)

The Earth does not "pull" the Moon. The pressure of the external environment pushes the Moon toward the Earth (Figure 9 on the right). The Earth is surrounded by closed vortices (magnetic fields). The effects of outgoing and incoming vertical field flows are compensated. Therefore, only horizontal components will produce an effect.

The horizontal components of the flow at a given point of the spherical surface are directed in all directions, i.e. there is spherical symmetry of the azimuthal flows. The near-Earth space is then seen as nested spheres, through each point of which flows of gravitons flow along the surface in all directions (Figure 10 on the left).

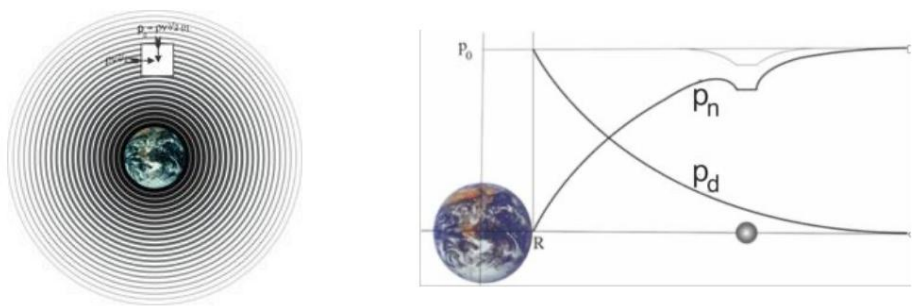


Fig.10. De Broglie vortex and pressures of the environment in the surface layer

Figure 10 on the right graphically shows the dependence of normal pressure on the height above the Earth's surface. According to Bernoulli's law, the field pressure p_0 near a body will be the sum of the normal pressure p_n and the tangential pressure of the dynamic flow pressure p_d . The formula: $p_n = p_0 - p_d$ will determine the normal pressure. The dynamic pressure of a vortex decreases with height as $1/r$. The force of gravity is the pressure gradient of the medium $f = dp_n/dr$. It is directed toward the Earth. The figure shows a second body (for example, the Moon). If the Moon were far from other bodies, the upper curve in the figure would represent

the pressure in the region surrounding the Moon. The superposition of the fields of the Earth and the Moon leads to a "hole" in the resulting curve p_n . The force of gravity on both sides of the Moon is the same and does not depend on whether it is a satellite of the Earth or not.

According to Newton's formula, at the moment of a solar eclipse, the Sun attracts the Moon twice as strongly as the Earth. However, the Moon does not fly away from the Earth. This paradox would be insoluble if the Moon were flying in a vacuum. But the planets fly in the Faraday-Maxwell electromagnetic field. Consequently, gravity should be described by Maxwell's equations, and gravity should be one of the electromagnetic phenomena. In electrical and magnetic phenomena, it is not the "charges" that actually move, but the "masses". It is this simple idea that allows us to combine electricity and gravity, to reduce electromagnetic phenomena to the mechanical action of a medium that has mass. Each body is surrounded by a de Broglie vortex (its own gravitational field) in the form of its own magnetic fluxes. The vortex magnetic flux surrounding the body is an analogue of Newton's gravitational potential. Let us express the Universal Law of Gravitation

through the solution of Maxwell's equation for a stationary magnetic vortex process:

_____ .

Here A is the linear vector potential, ∇^2 is the Laplace operator, ∇ [m/s] is the speed of light, ϵ_0 [kg/m³] is the electric constant, J [kg/ (s _____ 2 m²)] is the flow vector of the electric current density. The vector potential of the field A at point (1) outside the body is found as the standard Newtonian potential of currents $J \nabla dV$ at point (2) inside the body:

_____ (1)

where r is the distance between points (1) and (2). Formula (1) reflects the fact of the existence of an electromagnetic field flux around the charge flux. The vector potential A of the electric current's own field is the linear density of the angular momentum of the field flux per coulomb of charge in the body or the linear density of the energy of the field flux per ampere of current flowing in the body. We take into account the action of electrical and magnetic quantities for one second, i.e. for $1.76 \cdot 10^{11}$ neutrino revolutions in an electron (to gain a charge of e) and for another second of particle passage (to gain a charge of one coulomb). But the gravitational vector potential A_g is the linear density of the energy of the field flux per

one revolution of a neutrino in a body. Therefore, to obtain the gravitational vector potential, we must divide the value of the electric vector potential by $(1\text{s}\ddot{\text{y}}1\text{s})$: $A_{gr}=A/(1\text{s}\ddot{\text{y}}1\text{s})$

The circulation of the linear vector **Agr** along a closed loop determines the magnetic flux Φ through this circuit:

(2)

Usually we understand the magnetic field \mathbf{B} as a directed vortex flow of gravitons. But in reality the gravitational (azimuthal) magnetic field B_{gr} and the gravitational (azimuthal) magnetic flow \ddot{y}_{gr} at a given point are directed in all directions. However, for consideration of the Bernoulli effect, different directions of flows are not essential. At low density, the action of counter flows of gravitons is summed up.

For weak fields, we apply the superposition principle. We express the gravitational vector potential of a body of mass M as the sum of the vector potentials of all neutrinos of the body, considering neutrinos as magnetic dipoles with an angular momentum of $(\hbar/2)/(1[s])$. In this case, we again take into account the angular momentum not per second, but per one

neutrino revolution. The neutrino mass is approximately taken to be equal to half the electron mass. Recall that the neutrino mass (like the photon) expresses itself in energy and transverse inertia. The number of neutrinos is equal to $M/(m_e/2)$. If the entire mass of the body is considered concentrated at one point, then the values of r_{12} can be taken out from under the integral sign. Then the expression for the linear density of the gravitational vector potential (1) is represented as:

$$\frac{1}{s^k} \quad \text{where } k = 1 [s^{-3}]. \quad (3)$$

Here $\tilde{\gamma}$ is a dimensionless coefficient. We will assume that the de Broglie wave of the neutrino is not entirely transferred to the field. A certain (proper) part of the motion always remains in the fragment of matter and cannot be transferred outside the fragment. The proper energy can be estimated by comparison with experiment.

The gravitational potential is the value of the gravitational magnetic flux. We find it from formula (2) as the circulation of the linear gravitational vector potential (3):

$$\frac{G}{c^2} = \frac{\text{gravitational constant}}{c^2}. \quad (4)$$

The vortex gravitational potential (4) is quantized. It is the sum of M/m_e quanta of the electromagnetic field. The gradient of the gravitational potential will determine the force acting on a unit mass. A force m times greater will act on a mass m :

This force acts from the external environment, which does the work in the gravitational field. The gravitational constant is determined only by fundamental constants:

The experimental value of the gravitational constant is $G=6.6738 \cdot 10^{-11}$ [N·m² /kg²], so $\gamma=0.92$. Each neutrino gives up 92% of its vortex field to the outside of the fragment when forming fragments. The remaining 8% of the flow ensures the adhesion of neutrinos inside the body. The gravitational constant G depends on both the parameters of the electromagnetic field (γ , c) and the parameters of the substance (h , m_e). In addition, it depends on the uncertainty of the coefficient γ .

Thus, Newton's law of universal gravitation is a solution of Maxwell's equation, as are the laws of Coulomb, Faraday, Ampere and Biot-Savart. This conclusion completes Maxwell's work. The electromagnetic field environment is responsible not only for electricity, but also for gravity.

Note also that in the Einstein equation of general relativity for the metric tensor there is no mass, unlike Newton's equation for the gravitational potential: On the right side is the energy-momentum tensor not of "mass", but of "relativistic mass", i.e. gravitational

fields: — — .

Conclusion

In the century before last, Michael Faraday put forward the idea that it is not the particles and bodies themselves, but the space between them, filled with an electromagnetic field, that organizes and supports all physical phenomena. In the last century, Louis de Broglie deepened this idea by proposing the concept of corpuscular-wave dualism. All particles rotate. Rotation generates a stationary de Broglie wave in the surrounding space with the same phase and frequency. This work shows that when particles combine into bodies, de Broglie waves come out and merge into a de Broglie vortex, forming a gravitational field. Gravity is an electromagnetic phenomenon, and Newton's Universal Law of Gravitation is a solution to Maxwell's equation.

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What is a Broglie wave?

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The de Broglie wave is a vortex of the electromagnetic field medium attached to a neutrino. When neutrinos combine into particles and bodies, the de Broglie waves of individual neutrinos come out, forming a de Broglie vortex. The mass of the vortex is the relativistic mass of the composite particle or body. The intensity of the de Broglie vortex decreases with distance from the boundary of the particle or body. In accordance with the Bernoulli effect, the gradient of the normal pressure of the external environment of the electromagnetic field in the volume of the vortex creates the force of gravity.

Maxwell's equation describes this process. We call the de Broglie vortices of planets and stars a gravitational field.

The nature of thermal radiation of the Universe in light of the latest achievements of quantum astrophysics.

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Various controversial phenomena in astrophysics are considered, including the denial of the Big Bang as the moment of the birth of the universe, the physical nature of the thermal radiation of the Universe, and the circulation of dark and baryonic matter in nature.

Today, with the creation of the largest space telescope, the James Webb, astrophysicists have the opportunity to look into the depths of the 13-billion-year-old Universe in the infrared range, and there they did not see the expected picture of the Big Bang. Astrophysicists are in a panic. In July 2022, a large group of astrophysicists published an article entitled "Panic!" [1]. Based on the latest conclusions of astrophysicists about the absence of the Big Bang at the moment of the birth of the Universe, the nature of the background radiation discovered in 1965 by A. Penzias and R. Wilson cannot be relict. And this means that the hypothesis of cold nuclear fusion in the cosmic environment as a source of background radiation, put forward by me back in 2018 in the article "Nuclear Fusion", is acquiring scientific status. Nature offers humanity various options for nuclear fusion: on the one hand, there is uncontrolled thermonuclear fusion, realized in the depths of the Sun and accompanied by coronal emissions, which have a detrimental effect on all life on the planets; on the other hand, there is thermal radiation of the Universe, realized in the form of cold nuclear fusion in the interstellar medium [2]. Academician V.E. Fortov in his book "Lectures on the Physics of Extreme States of Matter" considered, in addition to astrophysical objects, the galactic and intergalactic cosmic environment (dark matter and dark energy), which accounts for 95% of the average density of matter in the Universe, while baryonic matter accounts for less than 5% [3]. V.E. Fortov's conclusion that "any transformation of matter includes a stage of strong compression under the action of gravitational forces and the subsequent strong heating and expansion due to thermonuclear energy release. Actually, these two mechanisms - compression and heating - determine the entire diversity of processes that occur in the Universe visible to us." turned out to be incomplete. In the extreme conditions of Space, this conclusion must be supplemented by the transformation of dark matter of the galactic and intergalactic environment into baryonic matter and back [4]. This is the cycle of matter in the Universe [5]. As the latest research has established, the behavior of dark matter is similar to the behavior of atoms in the Bose-Einstein condensate (quantum fifth

state of matter), obtained at a temperature of matter close to absolute zero - 273.5 Celsius or 0 Kelvin. In June 2020, the Bose-Einstein condensate was successfully recreated in Earth orbit, on the International Space Station (ISS) [6].

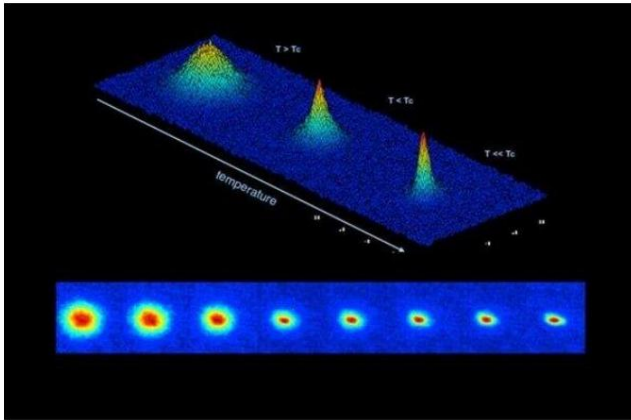


Fig. 1. Bose-Einstein condensate

Only there was it possible to create everything conditions for the emergence of quantum fifth state of matter during a few seconds, but it was enough for scientists to get representation of How exactly moving dark matter and why we can't see or feel it. [6]

Now, physicists say that instead of studying empty space, they can study Bose-Einstein condensates.

In the paper "Fundamental Dissipation by Bound Fermions in the Zero Temperature Limit," physicist Samuli Auti et al. found that: "Superfluid helium-3 feels like a vacuum to a rod moving through it, even though it is a relatively dense liquid. There is no resistance, no resistance at all," exclaimed physicist Samuli Auti of Lancaster University in the UK. He wrote: "I find this very intriguing. Superfluid

"A liquid is a fluid that has zero viscosity and zero friction and therefore flows without losing kinetic energy. It is relatively easy to make from the bosons of the isotope helium-4, which, when cooled to just above absolute zero, slow down enough to overlap and form a cluster of high-density atoms that act as a single 'superatom' of dark matter" [7].

The authors of the book "Vacuum: Concepts, Structure, Properties" V.V. Dikumar and A.A. Tyunyaev write: "Under normal conditions, a vacuum quantum behaves like a quasiparticle in a condensed state. In a state of excitation, a quantum vacuum loses its initial state and passes into a new one - into the state of the neutron n , which then passes into three particles, the proton p , the electron e^- and the antineutrino $\bar{\nu}$ » [8]. In the process of neutron birth, several types of elementary particles are released. They form the corresponding radiation, by the combination of which, it is possible to detect the processes of birth of the neutron, proton, deuterium and

tritium:

γ -quanta – form γ -radiation;

neutrino – neutrino radiation;

electrons and positrons form γ -radiation;

The single neutrons produced n produce neutron radiation;

Neutrons grouped in pairs form γ -radiation [8]. It is in such an interstellar medium that

cold nuclear fusion occurs, predicted by Professor Lev Sapogin back in 2008 in his monograph "Unitary Quantum Theory and a New Source of Energy" and allowing the creation of thermal background radiation of the Universe in the microwave range from 10 GHz to 33 GHz. [9]. This radiation, discovered in 1965 by A. Penzias and R. Wilson, was later called "relict" by astrophysicists [10]. The reason is that, in the standard model of the Big Bang, the problem of thermal cosmic radiation has a convincing solution. At high density immediately after the explosion, matter and radiation were a homogeneous mixture and, interacting with each other according to the laws of statistical physics, reached an equilibrium distribution and throughout subsequent history maintained it, despite the progressive decrease in temperature. An important feature of the observed cosmological background is the frequency distribution of energy. Black body radiation (with an effective temperature of 2.7 degrees Kelvin) has been recorded in nature. The COBE satellite measured the spectrum of the cosmic background radiation (Fig. 2); each square in this figure corresponds to a specific measurement. The three curves presented show the dependence of the black body radiation intensity on the wavelength for three different temperatures.

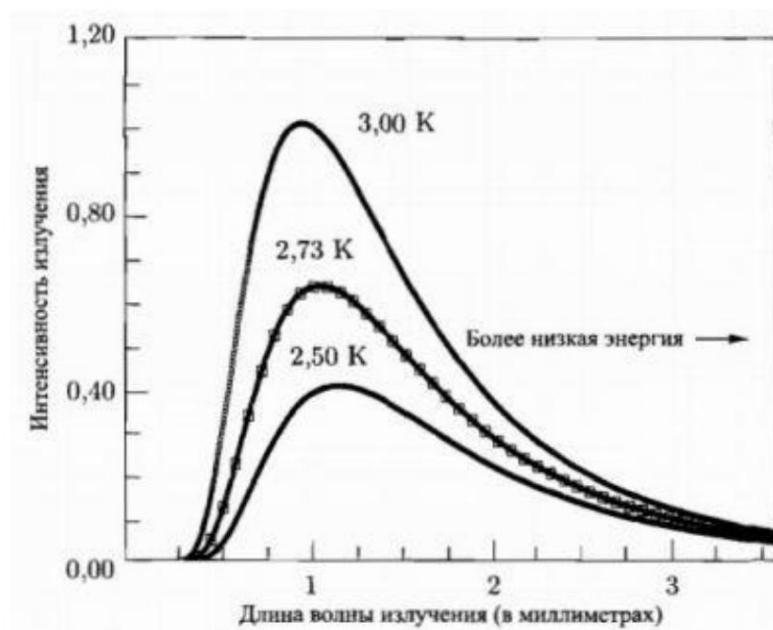


Fig. 2. The COBE satellite measured the spectrum of cosmic background radiation

Note how closely the COBE measurements match the curve representing blackbody radiation at 2.73 degrees. The Big Bang theory predicts the exact shape of this curve. However, astrophysicists' initial assumption that the background radiation was isotropic was disproved by more precise measurements in NASA experiments conducted in 1989 -

1992 using the Cosmic Background Explorer (COBE) spacecraft [11]. It was found that the anisotropy of the cosmic background radio emission depends

from the density of the cosmic environment: in the direction of space with a higher density it is "hot" ($T = 2.732$ K), and in the direction with a lower density - "cold" ($T = 2.724$ K). The successive movement of the anisotropy of the background radiation in the microwave range of 10 GHz - 33 GHz is characterized by a temperature difference in two diametrically opposite directions:

$$\tilde{T} = T_0 [1 + (v/c) \cos \tilde{\gamma}] \quad (1)$$

where $\tilde{\gamma}$ is the angle between the line of sight and the velocity vector of the observer relative to the background radiation of the Universe [11]. After processing the spectrograms and taking into account the motion of the Solar System, it was found that in the direction of motion, where the cosmic environment is compressed, the temperature of the background radiation is higher, and behind, where the cosmic environment is rarefied, the temperature is lower. Thus, the background radiation in the near-Earth region forms a temperature dipole, the apex of which is directed towards the Earth's motion (Figure 3)

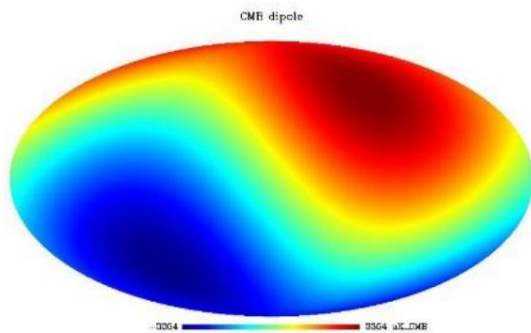


Fig. 3. Temperature dipole of background radiation near the Earth

This confirms the theory of Professor Valery Etkin on the uneven distribution of cosmic matter in the Universe. Professor Etkin proposed a modification of Newton's law based on the recognition of the non-uniform distribution of dark and baryonic matter in the

Universe [12]. It is natural to assume that the emergence of a temperature dipole of background radiation in the vicinity of the Earth is associated with the process of cold nuclear fusion occurring in the anisotropic near-Earth space environment. The higher the density of the near-Earth environment (its compression), the more intense the reaction of nuclear fusion and the higher the temperature of the background radiation.

Professor Lev Sapogin proves in his monograph that in space, even with At a temperature close to absolute zero of 2.73 K, cold nuclear fusion can occur during particle tunneling. [9] This is facilitated by irradiating the vacuum with external $\tilde{\gamma}$ -quanta. In this case, in addition to the synthesis of matter, thermal energy is released.

energy sufficient to heat the vacuum and create a spectrum of cosmic thermal radiation in the range from 10 GHz to 33 GHz [9]. As confirmation of his conclusions, Sapogin refers to experiments by American scientists who managed to establish tunnel effects near absolute zero temperature (in liquid helium) [13].

In conclusion, I propose to make a small historical excursion. Back in 1980, employees of the Pulkovo Observatory, professors A.A. Efimov and A.A. Shpitalnaya, in their article "On the issue of the motion of the Solar system relative to the background radiation of the Universe" [14] directly stated that it was impossible to call the background radiation

relics is completely unauthorized. Based on a large number of observations of phenomena of different nature in the near-solar space, Efimov and Shpitalnaya managed to construct triaxial anisotropy ellipsoids, the orthogonal forces in which are directed respectively: to the center of the Galaxy, to the Apex of the Sun and along the axis of rotation of the Sun (this direction is almost perpendicular to the direction to the center of the Galaxy). It should be noted that the results obtained after machine processing are quite reliable. For example, for 3324 flares, the statistical estimate of the significance of the result is $8\tilde{y}$, where \tilde{y} is the standard of the random variable. Anisotropy in the direction of movement to the Apex of the Sun is expressed in the violation of the symmetry of flare activity relative to the plane perpendicular to the direction to the Apex. Due to the movement relative to the material background of the Universe, some anisotropy also exists in the structure of our Galaxy, as well as in the structures of other galaxies flying at speeds of several hundred kilometers per second to their Apexes relative to the background radiation. These observations of astronomers from the Pulkovo Observatory remained unnoticed by the scientific community.

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The nature of the thermal radiation of the Universe in the light of the latest achievements of quantum astrophysics.

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Various controversial phenomena in astrophysics are considered, including the denial of the Big Bang as the moment of the birth of the universe, the physical nature of the thermal radiation of the Universe and the circulation of dark and baryonic matter in nature.

What the History of Physics Helps Us Predict About the Development of the Microplasmoid Field

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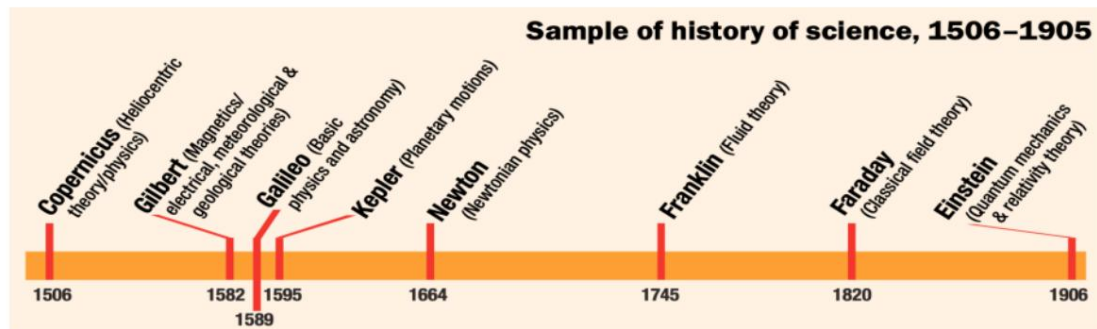
Physics develops through paradigm change, and paradigm change happens every 80 or so years because paradigm change is a 3 generational process. The change paradigm cycle causes the Kondratieff Wave in economic development. In 1989, I realized that a paradigm shift in physics was happening based on cold fusion, ball lightning, and other anomalies of the crisis period from 1970 to 1989. Based on the past timing and pattern of paradigm development, we can predict the timing of what might happen in the future development of this microplasmoid field and the plasmoid paradigm.

Physics develops through paradigm change, and paradigm change happens every 80 or so years because paradigm change is a 3 generational process. See Figure 1. The series or cycles of scientific revolutions that continue until now began in 1506, but there is evidence that the cycle was happening before 1506 too. The paradigm changes, times of scientific revolution in physics, result in industrial revolutions about 60 to 70 years afterwards generally. In 1989, I realized that a paradigm shift in physics was happening based on the cold fusion, ball lightning (BL) and other anomalies of the period from 1970 to 1989. Nowadays, some of the leading theorists who propose a model of what I call "microplasmoids" and what Russians usually call "strange radiation" are saying that a paradigm shift is happening in physics. Among these are Mishinsky and Lutz Jaitner. Scientific revolutions and the development of paradigms of physics are a 3-generation process, and based on the past timing and pattern of paradigm development, we can predict the timing of what will happen in the future development of this microplasmoid field and the plasmoid paradigm.

Three Generations For a Paradigm

Each paradigm shift in physics has had three generations who developed the paradigm. **In the first generation**, usually a young man in his 20s who grew up during a "crisis period" in physics interprets the anomalies and unsolved questions in physics with a new point of view that he thinks according to in order to interpret the anomalies. This new point of view is a theoretical way of thinking that is based on his own hypotheses and assumptions that he gathered while observing and trying to understand the anomalies. I call these people theoretical formulators. Sometimes, the theoretical formulators are older than 30 as Franklin was, but the qualifying characteristic is that they are inexperienced with the standard theory of their time. Franklin was relatively uneducated in Newtonian theory when he started his

physics research independently. Of course, more than one man may independently formulate a paradigm theory at the same time. This happened during the 1580s and 1590s when Gilbert, Galileo, and Kepler more or less independently formulated slightly different theories. However, they mostly agreed with each other about theory. Galileo and Kepler, for example, wrote letters to each other and told each other that they agreed with Gilbert's physics ideas.



The second generation is born about the same time a theory is first formulated. They grew up familiar with the new theory and understand the need for the theories of the paradigm to be developed, and they help to develop the theory to a high level by about 40 years after the theory was formulated.

Then a third generation who were born during the time the theory was being developed grew up who study the developed theory. When they reach middle age, they try to apply the developed theory for technological innovations, and some then do experiments that help them to discover anomalies to the theories that they believe. The time during which major anomalies are discovered that lead to the formulation of a new paradigm was called a “crisis period” by Kuhn in his famous book called *The Structure of Scientific Revolutions*.

The crisis periods last about 10 or 20 years according to him.

For more information about the theory of cyclic paradigm change and examples from the history of science, see this article that was published two years ago in *Cycles Magazine*[1].

Example of the Quantum Mechanics/Relativity Paradigm

Each paradigm shift in physics has had three generations who developed the paradigm.

For an example of the three generation process of paradigm change, consider the development of quantum mechanics and relativity theory in the early 1900s. From about 1883 to 1905, there was a crisis period in physics. One of the major anomalies that were discovered was that the speed of light does not vary based on direction as was expected theoretically by those who believed in Field Theory. This effect was discovered by Michelson who was born in 1852 and Morley. Other anomalies were discovered such as particles, black body radiation, and the photoelectric effect. By learning about and trying to understand these anomalies, Einstein introduced a new point of view, a new paradigm, with

new basic ideas for quantum mechanics and relativity theory in 1905. The hypothesis of quantum of energy, the idea of mass and energy equivalence, and the basic ideas of special relativity theory are among the basic hypotheses and assumptions he introduced for his paradigm.

Then, the second generation who were born about 1905 and grew up familiar with his ideas helped the two theories, general relativity for gravity and quantum mechanics for energy and atomic theory, to develop to full development in the 1930s and 1940s. These second generation theoretical developers included Heisenberg who was born in 1901 for quantum mechanics and Chandrasekhar who was born in 1910 for astrophysics and relativity theory. Physicists including Tomonaga and Schwinger who was born in 1918 helped to develop Quantum Electrodynamics to a high level and received Nobel prizes in 1948. By about 1950, the theoretical development was mainly completed.

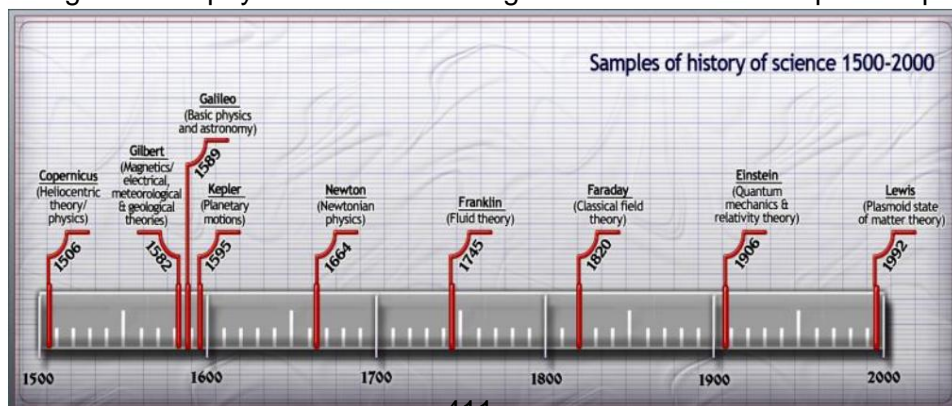
Then, a third generation who were born during the time the theory was being developed started to introduce new technology based on quantum mechanics and new scientific apparatus, and they started to discover anomalies in the crisis period from 1970 to 1992.

- About the year 1970 and for some years afterwards, BV Deryaguin who was born in 1902 and others discovered “polywater” properties.
- During the 1980s, Ken Shoulders who was born in 1927 studied what he called EVs. I call these micro ball lightning (MBL) or microplasmoids. Ken considered the EVs to be little components that he discovered in the larger plasmoids studied by Winston Bostick from the 1950s to the 1970s.
- In 1986, Johannes Bednorz who was born in 1950 and Karl Müller discovered high temperature superconductivity.
- In 1989, Stanley Pons and Martin Fleischmann who was born in 1927 announced they discovered fusion in electrolysis cells. They had been working on this kind of experiment secretly in the late 1980s.

The announcement of this effect that came to be called “cold fusion” started much experimental research, discussion, debate, and suppression for a few years until about 1997.

Development of the Plasmoid Paradigm

Each paradigm shift in physics has had three generations who developed the paradigm.



Matsumoto was one of the early experimenters who tried to replicate the Fleischmann and experiment. He was born in 1942 at a time when the basic theory of quantum mechanics was close to fully developed, and he learned quantum mechanics as he was growing up. He was one of the third generation of people who helped to discover anomalies during the crisis period from 1970 to 1992. When he did experiments with heavy water and palladium, he discovered some major anomalies. The first one he published about was that by using EDX to analyze his electrodes, he discovered that many elements were present in his electrodes that were not there

previously, and that these elements were concentrated



in microscopic voids and cavities. This started the research on transmutation of elements heavier than hydrogen that became a main research topic by the middle of the 1990s. Bockris, Miley who was born in 1933, Patterson, and many others including Shoulders started to do experimental research on heavy element transmutation about the middle of the

1990s.

Then in early 1992, he announced in *Fusion Technology* that the particle detection films he had arrayed next to this remarkable electrolysis cell had registered strange tracks he had never seen before

that were micrometer-sized rings and lines. He believed that the cell that produced the transmuted atoms also emitted something that caused the tracks and traces, but he didn't know what caused them.

I realized he was producing MBL because he reported he had discovered ring markings, and ball lightning is known to leave behind characteristic ring markings. See Figure 3 by Matsumoto. I told him this hypothesis, and Matsumoto started to research about micro ball lightning in 1992. I told him that it was the MBLs in his palladium electrode that caused the transmuted atoms he found inside the electrode. There was a range of different elements in what had been a pure palladium electrode. These MBL left the cell by going through the glass container the way that BL is able to do. This was part of the evidence those were really MBL that made the ring tracks and linear tracks on the particle detector sheets.

Matsumoto's and Ken Shoulders' work helped me to understand that there is a 5th state of matter in the early 1990s that I called the ball lightning state or the plasmoid state. See the chart in Figure 2. However, because there was a lack of evidence since these anomalies were never widely studied around the world and few really understood their existence, I felt there

was not enough evidence to develop a complete theory. All I could do is try to guess about the structure and properties of this kind of matter.

What is happening now might be similar to what happened with the Copernican and Galilean paradigms. Because there was strong opposition from the Catholic leadership against heliocentric theory and their physics, both men hid much of their work until they were old. However, both paradigms developed in about 80 years anyway. Since there is strong opposition now, I do not know when the world will generally accept this physics.

Predictions about Future Theoretical, Experimental and Possible Industrial Development of the Plasmoid Paradigm

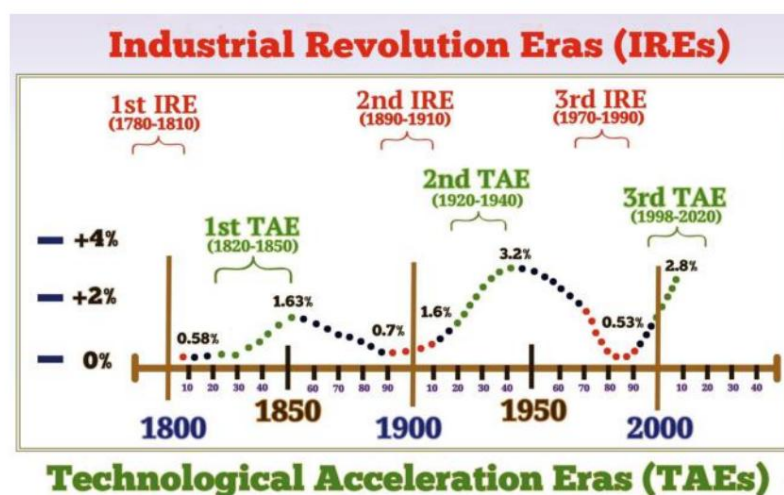
The second stage of extensive theoretical development usually starts about 20 years after theoretical formulation. The second stage ends about 40 years after the theoretical formulation, in this case, 2032, and then during an industrial revolution based on the new paradigm, new industries based on plasmoid theory might start to be built about 60 or 70 years after the theoretical formulation in 1992.

Because scientific revolutions in physics happened approximately every 80 years, there have been industrial revolutions when the theory of each paradigm were well developed and the inventors started to introduce new technology. Figure 4 shows that when the three industrial revolutions (IRE) have happened and how they coincided with an industrial revolution economic depression era when old industries were dismantled and disappeared and new industries began that involved the work force and resources of the United States.

The chart also shows when the Technological Acceleration Depressions (TADs) occurred.

You can see that the depression eras are spaced approximately 40 or 50 years apart, and this is the cause of the Kondratieff Wave that Nikolai Kondratiev wrote about economics articles in the 1920s and 1930s. The two kinds of depressionary eras in the US alternated.

The cycle was 1780 (IRD), 1830 (TAD), 1890 (IRD), 1929 (TAD), 1973 (IRD), and 2008 (TAD). This long economic cycle or economic wave in the US and other leading industrial economies is called the Kondratieff Wave.



Evidence That This Kondratieff Wave and Science Cycle Theory Is Valid

Evidence that this theory is valid is that it gives accurate predictions. The theory was developed in 1989. In the 1990s, I predicted in several articles that productivity growth acceleration would begin about the year 2000, that there would be an economic boom from 2000 to about 2009, and that there would be a financial crash like the 1929 crash about the year 2009. The predictions were accurate.

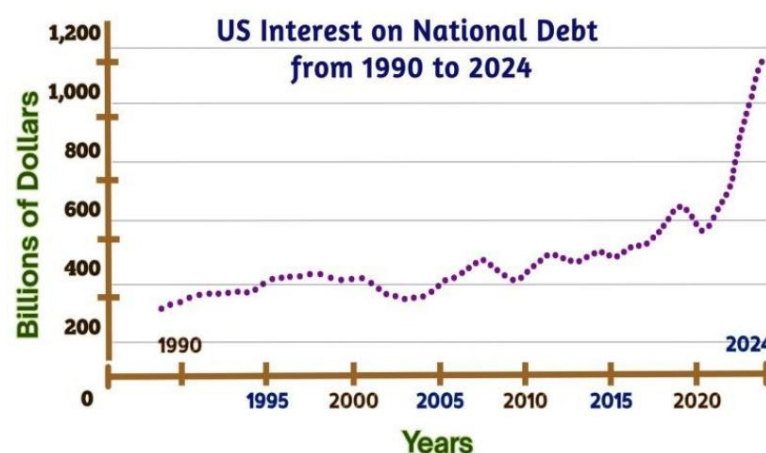
In the 1990s, the theory predicted that after 2009 there would be an economic depression era similar to the 1930s depression. This depression started in 2008 actually, and there were many bank failures, a surge of consumer bankruptcies, and a jump in unemployment as I had predicted. However, after 2008 until now, HUGE MASSIVE deficit spending in the US and some other countries have kept people working and supplied with a sufficient amount of funds so there hasn't been a visible depression.

Now, however, unprecedented peacetime deficits keep the government operating, and people get government subsidies to consume and survive. The National debt is expected to reach \$36 or \$37 trillion in 2024—and the deficit will total about \$3 trillion in 2024.

Government deficit growth has accelerated: The debt has more than doubled in the 5 years since 2019 when it was \$17 trillion. Roughly \$31 of the \$37 trillion has been added since 2008. The debt to GDP ratio in January 2024 was 123%. The previous record was 119% in 1946, after WWII.

As the Figure 5 shows, the interest on the US National debt is now exploding too. In 2024, the annual interest is almost double what it was in 2020. The government must borrow to pay this interest of over a trillion dollars this year.

It seems obvious that, without the approximately \$31 trillion of government borrowing from 2008 to the present, we would have suffered a severe depression. At this point, we're still on the downside of the Kondratieff long wave.



Predictions for the Next 40 or So Years

If a sufficient number of young people in their teens or early 20s or older people who are inexperienced learn the basic ideas of this new paradigm and it becomes their paradigm,

then they might help to develop this paradigm by about 2032. $2032 = 1992 + 40$ years. By then, the paradigm might be generally accepted. Even if it isn't, generally accepted but is accepted by enough people, then major technological development leading to the development of entirely new industries might begin about 2052. $2052 = 1992 + 60$ years.

These major technological innovations will be made by people of the third generation of this paradigm who were born about the time when the theory is being developed by the second generation.

So based on the timing of the Kondratieff Wave, an industrial revolution based on plasmoids might start in the 2050s. At the same time, the technological innovations will also enable the development of new types of scientific instruments and experimental equipment that are based on plasmoid theory that will enable people to discover major anomalies. So a physics crisis period might start around the same time about 2052 or 2057.

At the same time, during the industrial revolution, there will be another depressionary era similar to the low productivity growth IRE depressions of the 1780s and 1790s, 1880s and 1890s, and the 1970s and early 1980s as the economies switch over to the development of industries based on plasmoid theory and quantum mechanics based industries begin to close down and become obsolete.

For example, nuclear power generation may become obsolete as people learn to make energy with plasmoid devices. This would be similar to the way that the whole wagon and carriage industry of the late 1800s was replaced by the automobile industry that was based on the technology of the Faraday paradigm.

Conclusion

Scientific revolutions have occurred in physics approximately every 80 years since 1506 when Copernicus first formulated this heliocentric theory and physics. This happens because the development of paradigm each until the crisis period stage requires 3 generations. This happens, as described in other articles such as Reference 1, because of two limiting factors on cognition and technological innovations.

This pattern seems to be continuing. The plasmoid paradigm seems to be developing slowly, and some people such as Jaitner have attempted to develop a quantum mechanical based theory for the plasmoids and microplasmoids. This is important so that we can understand the 5th state of matter better and for experimental work to be accomplished.

However, as far as I have seen, young people are familiar with BL, 5th state matter properties and characteristics, and the experimental results. I feel that experimental research has only just begun on this state of matter. It may be important for the theoretical development of this paradigm that many more people, especially young people, believe that the microplasmoids exist and cause transmutation. So far, budgets have been small and experimental researchers have not worked with the best equipment available. This is important so that the characteristics and properties of fifth state plasmoids and

microplasmoids may be better understood. Also, astrophysical plasmoids and atmospheric plasmoids must be studied intensively.

Perhaps in the future, according to the timing described above, younger people may develop new theories of this paradigm by the 2030s, and another plasmoid industrial revolution might begin in the 2050s coinciding with a crisis period in physics and an industrial revolution depressionary period.

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What the History of Physics Helps Us Predict about the Development of the Microplasmoid Field

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Physics develops through paradigm shifts, and paradigm shifts occur approximately every 80 years because paradigm shifts are a three-generation process. The cycle of paradigm shifts causes a Kondratieff wave in economic development. In 1989, I realized that the paradigm shift in physics was occurring based on cold fusion, ball lightning, and other anomalies of the crisis period from 1970 to 1989. Based on past timeframes and patterns of paradigm development, we can predict the time of what may happen in the future development of this microplasmoid field and plasmoid paradigm.

Mechanico-mathematical substantiation of the scientific provisions of the poem "On the Nature of Things" by Titus Lucretius Carus

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The famous poem "On the Nature of Things" by the ancient Roman scientist and philosopher Titus Lucretius Carus, published in the 1st century BC, experimentally substantiates the scientific concepts of the materialistic direction of the ancient Greek natural philosophy of Leucippus-Democritus-Epicurus and quite reasonably introduces the concepts of the atomism of matter and the materialized

ether. However, the absence in those distant times of a developed mechanical and mathematical apparatus for describing the physical and biological processes of the "nature of things" did not allow the author to support his scientific positions with the corresponding formulas and mathematical proofs. Today, this gap can be filled quite clearly, which is what the content of the work is devoted to. In particular, the fundamental foundations of field theory as a materialized physical vacuum - a carrier of weak electromagnetic longitudinal-transverse disturbances and gravity theory are considered. The classical methodology of a gaseous continuous medium in the boundary layer approximation is used, an extended system of Maxwell's equations is obtained and its integration is carried out by the method of characteristics. The physics of "strange" radiation, various types of tracks, superluminal motion of matter and soliton clots of light is explained. Accurate analytical solutions for solitons and ball lightning are given. Mathematical modeling of the ancient concept of the soul and mind of man in the form of longitudinal-transverse displacements and voltages (Maxwell's displacement currents) is also presented. In the original text of the poem, Lucretius uses and explains the meaning of the Latin term "potestas", which literally means "inner power", and thus can be interpreted from a modern perspective not only as "potential energy", but also as internal energy released as a result of cold nuclear fusion.

Introduction

At the General Meeting of the USSR Academy of Sciences, held on January 15-19, 1946, the President of the Academy of Sciences, Academician S.I. Vavilov, presented a brilliant report entitled "The Physics of Lucretius" [1]. Here is the first paragraph of this report:

"Hardly any other poetic and scientific work of antiquity, even if we speak of the works of Homer, Euripides, Euclid, Archimedes, Virgil and Ovid, has brought to our days through the millennia such freshness and topicality as the unfading poem of Lucretius. Cicero and Virgil admired it, the "fathers of the church" irritably attacked it, rightly seeing in Lucretius

terrible danger for himself. This poem defined many features of the worldview of Newton and Lomonosov, delighted Herzen, deeply interested the young Marx and served as the banner of the mechanical materialism of L. Buchner."

The present work continues to examine this "poetic and scientific work of antiquity", providing it with a mechanical and mathematical justification of the main fundamental materialistic scientific principles.

In order to demonstrate the form of presentation and style of the poem "On the Nature of Things" by the ancient Roman scientist and philosopher Titus Lucretius Carus [2], it is appropriate to cite a number of characteristic quotes:

***"Now you strain your hearing and your insightful mind
Free from worries, listening to reliable teaching,
So that the gifts I offer with impartial zeal,
Before evaluating them, he did not reject them with contempt,
For I am going to speak about the essence of the highest heavens and gods
I began to reason for you and explain things..."***

Below, several more times, we will cite lines from two outstanding translations of Lucretius's poem into Russian, illustrating the scientific questions under consideration. The first translation was made at the turn of the 19th and 20th centuries by theologian Ivan Rachinsky [2], a member of the Russian "Religious-Philosophical Society", the second, later translation was made in Soviet times by the famous translator F.A. Petrovsky [3].

It seems quite interesting to give a brief historical background indicating the origins of the materialistic trend in science. As early as the 14th century BC (100 years before the fall of Troy), the scientist-philosopher Mochus taught his followers and fellow citizens in Sidon, the capital of Phoenicia [4] (we cite the corresponding quotation from the poem):

***"The birthplace of our soul
I have it a lot less,
Than those from which they are composed
"Body with womb!"***

The fundamental materialistic position on "our soul" formulated in these lines receives a detailed justification and an expanded formulation in Lucretius's poem:

***"So it is clear from here,
What is the essence of the soul and reason
It was all created without a doubt
From the smallest primary bodies,
Which lack of gravity
"It doesn't detract from it at all."***

The question of the "essence of soul and reason" is central to the present work and below an attempt will be made to give it an expanded mathematical justification with

modern positions of mechanics, biology, theory of neural networks and artificial intelligence. It is appropriate to note here that the Nobel Prize in Physics in 2024 was awarded "for fundamental discoveries and inventions" in the field of machine learning and neural networks. The problem below is reduced to modeling the propagation of longitudinal-transverse displacements and stresses in a continuous medium filling the space and lines of a neural network, in which, along with the electrodynamic vector force field, a scalar pressure force field is considered. The corresponding systems of linear equations of acoustics, elasticity and electrodynamics will be presented and integrated with careful fulfillment of the three basic laws of conservation of mass, momentum and energy.

Returning to the poem of Lucretius, it is important to point out that the scientific concept of the poem fully corresponds to the foundations of modern classical mechanics of continuous medium and quite reasonably introduces the concept of atomism for the entire "nature of things" (including for the materialized ether). The discussion of the scientific concepts of the poem was previously carried out, in particular, by A. Einstein, S.I. Vavilov, V. Vandeke and others [1,5,6]. Thus, the first phrase of the introductory article by A. Einstein is very characteristic: "The book of Lucretius will have a charming effect on everyone who has not yet been completely conquered by the spirit of our time, who feels capable of looking at modernity from the outside and evaluating the spiritual achievements of contemporaries." The listed authors analyze in detail the physics of Lucretius [1], the problem of reality and the theory of knowledge [6], as well as the philosophy of Lucretius [5,6]. Here, the citation of the following lines can serve as characteristic examples:

"...nothing is created out of nothing, even by the will of the gods,"

"...the fundamental principle of things, by which everything is founded, strengthened, grows and multiplies in nature, also – into which nature transforms all things after death,"

"feelings do not exist in the body before the nature of a living creature is born in it,"

"In order to open the way to our feelings, they need to break through certain tissues in our bodies."

In conclusion of the introduction, we will also dwell on the rather accurate definition of the concept of time in this poem:

***"Time does not exist in itself, but in objects,
We all feel it when something happened in the past,
Is this happening now, or will it follow in the future...
And there has never been anyone who has considered time
Outside of its connection with the movement of bodies and their sweet peace."***

The author of the poem's reasoning about space, the size of the Universe and a whole series of other scientific questions related to the study of the "nature of things" can be considered sufficiently reasoned. Let us move on to a specific mechanical-mathematical analysis of a number of fundamental problems.

1. Longitudinal waves of displacement and stress in a continuous medium

Following Maxwell [7], we will analyze the electric field strength associated with displacement, in our case, with the displacement of charged particles

particles of the medium (or displacement current, leading to the appearance of displacement intensity). In addition to Maxwell's approach, we consider not only the transverse displacement of particles of an incompressible medium, but also the total longitudinal-transverse displacement of particles of a compressible medium, leading to the appearance of an additional component of displacement - its longitudinal component [8]. Let us present the corresponding mathematical description of such a total longitudinal-transverse displacement in the form of a displacement vector . For a sufficiently small displacement, we will use the well-known Helmholtz theorem on the decomposition of an arbitrary vector field into potential and solenoidal components

$$\vec{u} = \text{grad } \vec{y} + \text{rot } \vec{v} \quad (1.1)$$

In linearized models of continuum mechanics, direct measurements of the magnitude of small displacements of points of the medium are difficult to implement, in connection with which measurements of the stresses arising due to these displacements are usually performed. Thus, in the mechanics of liquids and gases, it is convenient to measure the magnitude of pressure, in the mechanics of elasticity - the elastic stresses arising during displacements, in electrodynamics - the stresses of the electric and magnetic fields. Another very important point in integrating equations is the possibility of using the same dimension for the sought quantities during integration (for example, it is convenient to relate pressure to a constant value of the impedance of the medium, obtaining the dimension of velocity for a changing value of pressure). We will do the same in electrodynamics with the values of the electric and magnetic intensity of the force vector field. The points noted below will be widely

be used and explained further.

Let us first consider longitudinal waves of displacement and stress in a continuous gaseous medium using the example of an acoustic problem. We begin with linearization and the corresponding transformation of the law of conservation of mass [9]. We write the differential equation of continuity

$$\frac{d\rho}{dt} + \rho \text{div } \vec{v} = 0 \quad (1.2)$$

The transition in (1.2) to the value of pressure p (taking into account the expression for the speed of sound $c^2 = dp/d\rho$) and linearization using the substitution $p = p_0 + p'$, $\vec{v} = \vec{v}_0 + \vec{v}'$ gives, instead of (1.2), the equation

$$\frac{dp'}{dt} + \rho_0 \text{div } \vec{v}' = 0 \quad (1.3)$$

case of a medium at rest in the form of a we have and we will consider For the time derivative of the displacement . We will write equation (1.3) in the form

$$\frac{dp'}{dt} + \rho_0 \frac{d\vec{v}'}{dt} = 0 \quad (1.4)$$

and for pressure by dividing by the impedance of the pressure let's move on to the value of the perturbed . Then medium with the dimension of velocity the relation (1.4) is written in integrable form as

$$\frac{dp'}{dt} + \rho_0 \frac{d\vec{v}'}{dt} = 0 \quad (1.5)$$

components characterizes a small change in volume during deformation. Recall that the principal (diagonal) of the Cauchy strain tensor describe the fact of stretching – compression in the directions of the coordinate axes, which is important for further discussion.

The second conservation law - the law of momentum - we will first write for an ideal gas

$$\frac{\partial p}{\partial t} + \frac{\partial}{\partial x} \left(p u \right) = 0 \quad (1.6)$$

and we will perform its linearization by entering the value

$$p = p_0 + p_1 \quad (1.7)$$

In displacements (1.7) it has the form

$$\frac{\partial p_1}{\partial t} + \frac{\partial}{\partial x} \left(p_0 u \right) = 0 \quad (1.8)$$

As a result of the transformations performed, a system of two acoustic equations with first derivatives in traditional disturbance variables was obtained

velocity and pressure disturbances expressed in the dimension of velocity

$$\frac{\partial u}{\partial t} + \frac{\partial p}{\partial x} = 0 \quad (1.9)$$

$$\frac{\partial p}{\partial t} + \frac{\partial}{\partial x} \left(p u \right) = 0 \quad (1.10)$$

or in displacements (1.5) and (1.8).

These systems of equations describe the propagation of only longitudinal disturbances with the speed of sound c *both* in free space and in any channel (or network of communication channels, such as a neural network) that are filled with a homogeneous medium with density ρ . At $t=0$, we have a medium at rest in the channel or in any other communication device that can transmit information.

When acoustic disturbances propagate, the law of conservation of energy and its flow is also fulfilled. The specific energy of a sound wave is the sum of the kinetic and potential specific components of energy [9]

$$W = \frac{1}{2} \rho u^2 + \frac{1}{2} \frac{p^2}{\rho c^2} \quad (1.11)$$

For a sound harmonic wave, the law of conservation of specific energy W and its flow is valid. As a result of the compression-rarefaction process, the specific energy W

is preserved and flows from specific kinetic energy to specific energy and back. The amplitude of the oscillation of the potential energy

magnitude of the velocity is equal to the magnitude of the maximum of the disturbed pressure divided by the impedance of the medium. The impedance of the medium is an important parameter of the medium, determining the correspondence between its kinematic and potential properties. Here it can be noted that the translator of Lucretius's poem "On the Nature of Things" Raczyński translates the Latin word *potestas* as "freedom" [2], and meanwhile this word means "inner power" (in the modern sense - potential energy).

The system of equations (1.7), (1.10) is integrated by the method of characteristics. In the one-dimensional case with independent variables (x, t) on the characteristics $dx/dt = \pm c$ compatibility conditions are met

$$\frac{du}{dt} + \frac{1}{c} \frac{dp}{dt} = 0 \quad (1.12)$$

here is the magnitude of the velocity in projection onto the x -axis. It is important to emphasize an important point that will be widely used later. It consists in the possibility of expressing the magnitude of the disturbed pressure (as well as the values of the intensities under consideration) in the dimensions of velocity.

The main result of this section is the demonstration of the fact of fulfillment of the laws of conservation of mass, momentum, energy and its flow when modeling the process of propagation of a mechanical sound wave. In the one-dimensional case, we have two characteristics of the right and left families with the corresponding transversality conditions (1.12). In the two-dimensional case, another family of doubly degenerate characteristics is added - these are streamlines, on which the compatibility conditions are the conservation of entropy and vorticity. Conservation of the specific total energy (enthalpy) on streamlines is a consequence of the law of conservation of the sum of potential (internal) and kinetic ("live force") energies. In other words, this is the sum of the law of conservation of entropy and the law of conservation of momentum multiplied by the velocity vector. In the three-dimensional case, streamlines are a family of triply degenerate characteristics. In conclusion of the section, it should be emphasized once again that one of the main paradoxes of Maxwell's electrodynamics is the absence of fulfillment of the laws of conservation of energy and its flow during the propagation of electromagnetic waves.

2. Longitudinal-transverse waves of displacement and stress in a continuous medium

Let us consider the propagation of longitudinal-transverse disturbances in a weakly compressible medium taking into account viscosity, which allows us to introduce transverse shear interaction of liquid layers, and we will show the features of Maxwell's methodology, implemented in the derivation of the equations of electrodynamics. The presence of compressibility of the medium makes it possible to introduce the longitudinal component of propagating disturbances into the analysis. We also take the continuity equation (1.2) and the law of conservation of momentum, expressed in differential form by the Navier-Stokes equations [9] as the initial conservation laws.

$$\frac{\partial \rho}{\partial t} + \operatorname{div}(\rho \mathbf{v}) = 0 \quad (2.1)$$

Using the vector analysis formula

we rewrite (2.1) in the form

$$\frac{\partial \rho}{\partial t} + \rho \operatorname{div} \mathbf{v} = 0 \quad (2.2)$$

or

$$\frac{\partial \rho}{\partial t} + \rho \operatorname{div} \mathbf{v} = 0 \quad (2.3)$$

Linearization (2.3) gives

$$\frac{\partial \rho}{\partial t} + \rho \operatorname{div} \mathbf{v} = 0 \quad (2.4)$$

For a vector field, we apply the Helmholtz theorem on decomposition into potential and solenoidal components

$$\mathbf{v} = \operatorname{grad} \psi + \operatorname{rot} \mathbf{A} \quad (2.5)$$

Now substituting (2.5) into (2.4) we can write

$$\frac{\partial \rho}{\partial t} + \rho \operatorname{div} \mathbf{v} = 0 \quad (2.6)$$

which in the linear case splits into two for the potential and solenoidal components of the velocity vector field

$$\text{---} \quad \text{---} \quad \text{---} \quad (2.7)$$

$$\text{---} \quad (2.8)$$

The next stage of the analysis of the propagation of longitudinal-transverse disturbances is performed by moving to displacements (1.1) and using the continuity equation. We have a system of equations (1.4), (2.7) and (2.8) in longitudinal and transverse displacements (1.1)

$$\text{---} \quad (2.9)$$

$$\text{---} \quad \text{---} \quad \text{---} \quad (2.10)$$

$$\text{---} \quad \text{---} \quad (2.11)$$

The system of linear equations (2.9) - (2.11) models the propagation of weak pressure disturbances and transverse displacements, as well as the velocities of these displacements in a continuous medium with undisturbed density . By passing to the magnitude of the displacements, we obtain from (2.9) the integral for the continuity equation. Further, to integrate equations (2.10) and (2.11) at sufficiently large Reynolds numbers, the method of characteristics can be applied.

We obtain the integrals of the system (2.9) - (2.11) for the case of propagation of potential and solenoidal components of the force fields of a hydrodynamic top, when the stresses are characterized by a scalar pressure field and a vector velocity field. For the perturbation of the scalar pressure force field, we again use the notation constant velocity of propagation of longitudinal waves. Equation (2.9) gives the integral

$$\text{---}, \text{---} \text{ having the dimension of speed, where}$$

$$\text{---} \quad (2.12)$$

We first consider equation (2.10) for sufficiently large Reynolds numbers, when the effects of viscosity can be neglected in the propagation of longitudinal potential disturbances. Then (2.10) is written as

$$\text{---} \quad (2.13)$$

We will represent the second-order equations (2.13) and (2.11) as systems of two first order equations. For (2.13) with acoustics (1.9) and (1.10) equations are repeated

$$\text{---} \quad (2.14)$$

$$\text{---} \quad (2.15)$$

For the one-dimensional case, such integration is presented below in this section of the work. The system describes hydrodynamic problems, in particular, pumping liquid through branched systems of channels. If the corresponding stresses of the force field are associated with the displacements, then the propagation of weak stresses of this force field is also modeled by this system. Thus, based on the system (2.9)

- (2.11) In the next section of the work, an extended system of Maxwell's equations for longitudinal-transverse waves of an electromagnetic force field is written out.

Before integrating equation (2.11), we rewrite it using the second Lamé coefficient μ [10,11], which allows us to move from the viscosity coefficient η for a Newtonian fluid and the velocity value in equation (2.8) to displacements. Instead of (2.11), when the equality is satisfied,

we have

$$\text{---} \quad (2.16)$$

Let us recall the fact that the second Lamé coefficient determines the distribution

transverse waves in an elastic medium with density with characteristic velocity =

Introducing the notation

instead of one equation

second order, we obtain two first order equations [12]

$$\text{---} \quad (2.17)$$

$$\text{---} \quad (2.18)$$

The system of equations (2.17) and (2.18) is identical to the system of Maxwell's electromagnetic equations for free space (without charges and currents) and actually reproduces his hydrodynamic method of deriving this system. In this case, it is equivalent to the magnitude of electrical induction, and size

intensity of the vortex magnetic field.

The result of this section is the conclusion that the propagation of disturbances in a continuous medium with a density for longitudinal waves occurs with a velocity and is described by the system (2.14) and 2.15), for transverse waves occurs with a velocity and is described by the system (2.17) and 2.18).

3. Longitudinal-transverse electromagnetic waves Any communication

lines contain a continuous medium and the transmission of electrical pulses along communication lines, including a network of such lines, can be described by an extended system of Maxwell's electromagnetic equations for longitudinal-transverse waves, which is derived from the material presented in the first two sections of the work (in the boundary layer approximation). Let us first note the fact that one of the essential paradoxes of the modern theory of electromagnetism is the failure to satisfy the law of conservation of energy and energy flow during the propagation of electromagnetic waves. Solutions to the linear system of Maxwell's equations simultaneously yield zero values of electrical and magnetic intensities in the same sections. However, in the presence of a material medium with non-zero density and pressure, we obtain a modification of Maxwell's theory for the case of transverse and longitudinal disturbances, the solutions of which satisfy the law of conservation of energy and its flow.

It is necessary to make some "summary" of the material presented above. Acoustics is traditionally considered within the framework of an ideal inviscid and non-thermally conducting gas. In the acoustic approximation, the laws of conservation of mass, momentum and energy are satisfied. We have a force scalar potential 424

pressure field and kinematic vector field of velocity. In the one-dimensional non-stationary case (with coordinates x,t) only longitudinal plane compression-rarefaction waves can be considered. The potential energy of these waves is determined by the square of the perturbed pressure value, the kinetic energy is determined by the square of the perturbed velocity value. The impossibility of changing the parameters along other coordinates excludes the presence of transverse perturbations and the presence of a solenoidal component (shear waves, vortices). However, in two-dimensional or three-dimensional cases, vortex perturbations are possible and mathematically they correspond to the presence of additional characteristics (streamlines) in the problems and the compatibility conditions on these characteristics.

In an elastic medium, reversible deformations of the medium and the presence of longitudinal-transverse deformation waves are considered [10,11]. The magnitude of the relative change in volume is expressed through the divergence of the displacement. In an elastic medium, there is no proper pressure and its participation in the description of compression-rarefaction waves. The propagation velocity of transverse waves is determined by the second Lamé coefficient μ , the propagation velocity of longitudinal waves - through both Lamé coefficients γ and μ , as $\gamma + 2\mu$. However, the interdependent all-round compression of an elastic body, specified using the compression modulus $K = \gamma + 2\mu/3$, is fundamentally different from the nature of the action of pressure, which plays a major role in gas-dynamic media.

Perturbations in an incompressible fluid, due to the constancy of density, have an infinite value of the propagation velocity of longitudinal waves. The traditional Maxwell equations obtained on the basis of this approximation model only transverse waves. In connection with the above, the propagation of longitudinal-transverse electromagnetic

disturbances in a compressible medium (including, considering as such a physical vacuum, which has its own density and pressure) is modeled by a system of gas-dynamic equations taking into account viscosity in the boundary layer approximation. As an initial model, one should take a weakly compressible medium with a large but finite propagation velocity of longitudinal waves in the presence of its own pressure, density and temperature, and the propagation velocity of disturbances in this medium should be equated to the speed of light in a vacuum (for both longitudinal and transverse waves). The initial equations here will be the equations of motion of a compressible gas in the "boundary layer" approximation (at sufficiently large Reynolds numbers, when the viscous interaction is taken into account only in the transverse direction). We have

(3.1)

(3.2)

After moving to offsets

using the derivative

linearization we write

And

(3.3)

(3.4)

Let us represent the displacement vector for the linear case in the form (1.1). Then the system (3.3) and (3.4) take the form

$$\frac{\partial u}{\partial t} = -\frac{1}{\rho} \frac{\partial \sigma}{\partial x} \quad (3.5)$$

$$\frac{\partial \sigma}{\partial t} = -\frac{1}{\rho} \frac{\partial \tau}{\partial x} \quad (3.6)$$

Equation (3.4) is divided into two

$$\frac{\partial u}{\partial t} = -\frac{1}{\rho} \frac{\partial \sigma}{\partial x} \quad (3.7)$$

$$\frac{\partial \sigma}{\partial t} = -\frac{1}{\rho} \frac{\partial \tau}{\partial x} \quad (3.8)$$

Next, we will consider the stresses in the analyzed continuous medium in the dimensions of velocity and introduce the notation

$$\sigma = \frac{1}{\rho} \frac{\partial \tau}{\partial x}, \quad \tau = \frac{1}{\rho} \frac{\partial \sigma}{\partial x} \quad (3.9)$$

and we move from the second-order equations (3.7) and (3.8) to the extended system of four first-order Maxwell equations (taking into account (3.8))

$$\frac{\partial u}{\partial t} = -\frac{1}{\rho} \frac{\partial \sigma}{\partial x} \quad (3.10)$$

$$\frac{\partial \sigma}{\partial t} = -\frac{1}{\rho} \frac{\partial \tau}{\partial x} \quad (3.11)$$

$$\frac{\partial \tau}{\partial t} = -\frac{1}{\rho} \frac{\partial \sigma}{\partial x} \quad (3.12)$$

$$\frac{\partial \sigma}{\partial t} = -\frac{1}{\rho} \frac{\partial \tau}{\partial x} \quad (3.13)$$

The key point of this conclusion is the fact of consideration of electric field strength with the inclusion of a vortex component which is associated with the transverse displacement of points of the medium and was called by Maxwell the displacement current. At the same time, for the magnetic field strength determined from the vortex component of the electric field, only the vortex component of the displacement remains. Another important point was the recording of the electric and magnetic field strengths in the dimensions of speed [m/s] by multiplying by constant coefficients (3.9).

Longitudinal waves carry specific energy

$$W = \frac{1}{2} \rho u^2 \quad (3.14)$$

including the kinetic W_k and potential W_p parts. For the specific energy waves and its flow, the conservation laws are satisfied. In the

one-dimensional case, the resulting linear equations are easily integrated by the method of characteristics. On the characteristics of the 1st and 2nd families

$$\frac{dx}{dt} = \pm c \quad (3.15)$$

for a plane wave the compatibility conditions are satisfied

$$\frac{d\sigma}{dt} = 0 \quad (3.16)$$

As a result of the transformations carried out, an extended system of linear Maxwell equations (3.10) - (3.13) was obtained, modeling compressible longitudinal (potential) and directly related incompressible transverse (solenoidal) waves. Below, a mechanical interpretation of the propagation of a plane electromagnetic wave will be presented.

4. Basic parameters of the "physical vacuum"

The initial values measured experimentally and determining the main parameters and conclusions of this work are the dielectric $\epsilon_0 = 0.8854 \cdot 10^{-11} \text{ Cl}^2 / (\text{N m}^2)$ and magnetic permeability of vacuum $1.2566 \text{ N s}^2 / \text{Cl}^2$, its measured temperature $T_0 = 2.735 \text{ K}$, speed of light $c = 2.998 \cdot 10^8 \text{ m/s}$ and Boltzmann constant $k = 1.381 \cdot 10^{-23} \text{ J/K}$. Another fundamental constant will be the average density of matter in the free space of the Universe, which is determined with a fairly high accuracy. In accordance with the works [13,14], we will take the density of the materialized medium of the free space of the Universe equal to the value. The experimental value of fundamental importance for the article is the registration of the final temperature T_0 of cosmic microwave radiation (CMR). The specified value of the CMR temperature was first experimentally measured in 1933 by the German scientist E. Reginer [15,16]. In 1956, a postgraduate student at the Pulkovo Observatory, T.A. Shmaonov, also recorded the final temperature of outer space $T_0 = 4 \pm 3 \text{ K}$ [17]. In 1965, two American radio astronomers, A. Penzias and R. Wilson, rediscovered the final temperature $T_0 \sim 3 \text{ K}$ of outer free space [18,19]. Following Ya.B. Zeldovich, the KMI can be considered a "new ether". This name arose as a result of the discovery in the 1970s of large-scale dipole anisotropy in the KMI [20,21]. With the help of careful flight experiments on a specially equipped U-2 aircraft,

A large-scale spherical dipole non-uniformity of $10\text{-}3 \text{ K}$ was registered in the temperature distribution of the CMI with an amplitude $\Delta T_a = 3.50.6$. This circumstance makes it possible to introduce a cosmological reference frame in the vicinity of our Milky Way galaxy, in which the background radiation is isotropic [22,23].

Let us give an accurate estimate of the mass m of the carrier of thermal radiation for the solid physical vacuum of the PV ("new ether", old ether, or, what is the same, dark matter) at the registered value of its temperature $T_0 = 2.735 \text{ K}$. We use the well-known equation of state $p = nkT$. Then, following [24,25], we determine the value of the mass m taking into account the value of the adiabatic index for the photon

gas $\gamma = 4/3$. We have

$$\rho = \frac{3}{8\pi} \frac{1}{kT} \approx 3 \cdot 10^{-27} \text{ kg} \cdot \text{m}^{-3} \approx 3 \cdot 10^{-10} \text{ eV} \cdot \text{m}^{-3} \quad (4.1)$$

We also obtain the uniquely determined gas constant of this materialized medium $R = k/m \approx 0.25 \cdot 10^4 \text{ J/Kkg}$ and the specific heat capacities 427

at constant volume and constant pressure: $c_v \approx 0.75 \cdot 10^{17} \text{ J/Kkg}$, $c_p = 1.0 \cdot 10^{17} \text{ J/Kkg}$. We write in the approximation of a perfect gas the traditional equation RT or $p \approx \rho \epsilon$ (1) states of a gaseous medium $p \approx \rho \epsilon$ where $\epsilon = c_v T - \epsilon_0$ is the specific internal energy.

An important experimental physical result for our study is the above-mentioned discovery of dark matter (DM) of the Universe in the volume of 96% of the total amount of matter. Below, DM is identified with the materialized medium (ether and physical vacuum), which should be considered as a carrier of the electromagnetic force field.

The next fundamental point of our analysis will be the definition of the structure of the considered TM particle. We postulate this particle in the form of a dipole with its own characteristic electric charge. In the presence of such a charge, it becomes possible to go from the virtual polarization of the physical vacuum [26, 27] to the real polarization of space. The elementary charge of the dipole is determined from the known data on the mass and charge of the electron [26, 27] and is $q_0 = 0.5 \cdot 10^{-28} \text{ C}$. Based on the estimates of the mass, charge and size of the proton and electron, we also obtain the linear size of the dipole $p = ql \approx 3.5 \cdot 10^{-48} \text{ C m}$ and the value of the particle dipole moment 20 m . At the same time, despite its calculated miniature dimensions, we believe that the known properties of electric dipoles are preserved. Thus, we will fulfill the above-mentioned properties of vacuum polarization, etc.

The magnitude of the charge and the permittivity of the vacuum $\epsilon_0 = 8.854 \cdot 10^{-12} \text{ K12 / (Nm}^2 \text{)}$ determine the characteristic linear size – the Debye screening radius $D = \sqrt{\epsilon_0 \epsilon k T / n_0 q^2}$ and the characteristic frequency $\gamma = \sqrt{n q^2 / \epsilon_0 m}$. Under isobaric conditions, the Debye radius increases linearly with increasing characteristic temperature $D \sim T$ (in particular, this circumstance is a clear explanation of the linear expansion of metals with increasing temperature). As a simple visual demonstration of the value of the Debye radius D we will indicate that in free space at $T_0 = 2.735 \text{ K}$, $n_0 = 3.6 \cdot 10^{14} \text{ 1/m}^3$, $q = 0.5 \cdot 10^{-28} \text{ C}$ the value of the Debye radius $D = 3 \cdot 10^4 \text{ m}$.

In the considered model of physical vacuum, the birth of an electron-positron pair in a vacuum is naturally simulated. The birth of such a pair occurs not from emptiness, but from a material environment with observance of all conservation laws: mass, charge, momentum and energy. The birth of a pair in our case should be interpreted as the destruction of a large number ($N \approx 10^9$) of dipoles under the action of an electric field with a strength of about 1020 V/m .

5. Mechanical model of electromagnetic waves

Based on the above material, we will present some illustrations of the possible structure of electromagnetic waves in free space, Faraday's lines of force and the introduced dipole 428

"ultra-elementary" particles (in the postulated form of dipoles). Let us begin by demonstrating the propagation of a plane electromagnetic wave in the form of segments of coupled dipoles and changes in its electric and magnetic intensities. Fig. 1,a shows the structure of coupled dipoles for only one wavelength, Fig. 1,b shows the distribution of electric and magnetic intensities and the corresponding distribution of pressure disturbance (Fig. 1,c).

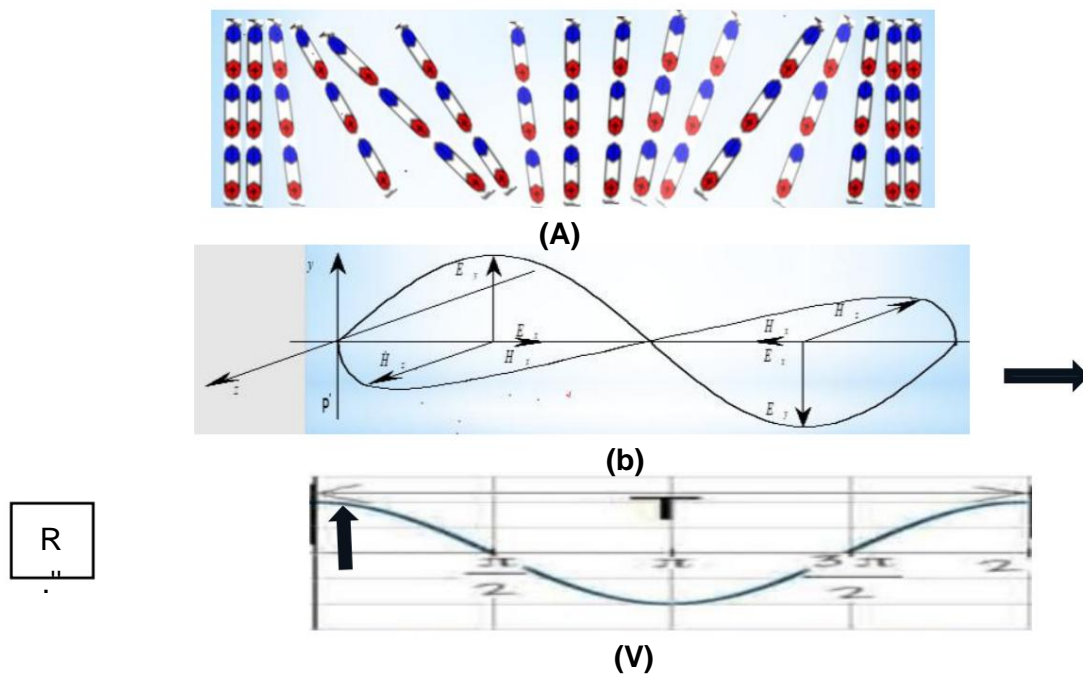


Fig. 1. A plane electromagnetic wave in the form of pieces of coupled dipoles (a), distributions of electric and magnetic intensities (b) and disturbed pressure (c).

Let us return to the question of Faraday's lines of force for the electromagnetic field in a physical vacuum. We accept Faraday's basic concept, which consists in the fact that the lines of force serve as a visual mechanical "materialization" for the electromagnetic field in a vacuum and in the polarized space of an atom. Fig. 2 shows a qualitative mechanical representation of the lines of force and dipoles (the lines of force of the field are shown by dashed lines).

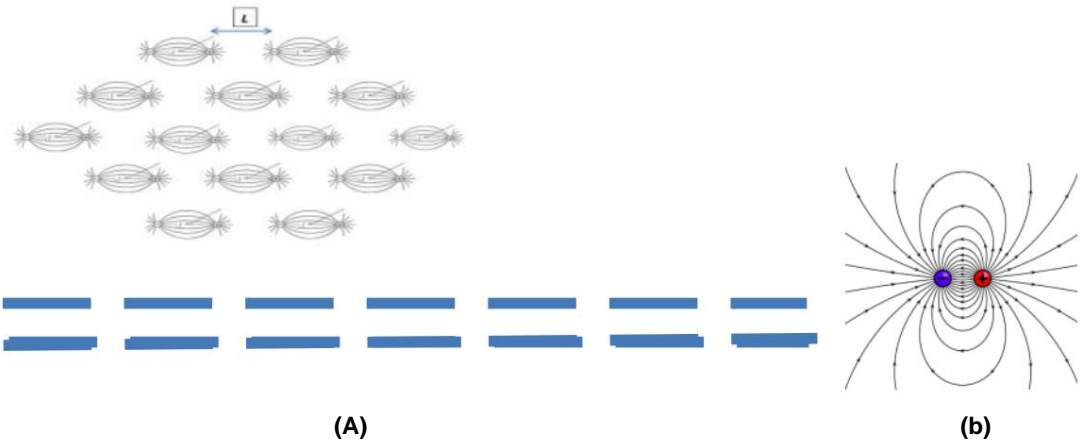


Fig. 2. Mechanical representation of three electric field lines **(a)** and the dipoles that comprise them **(b)**.

We consider the lines of force of the electric field to be composed of the elementary dipoles considered in our work.

Fig. 3 shows the diagnosed image of the polarized space of a gold ion [26],

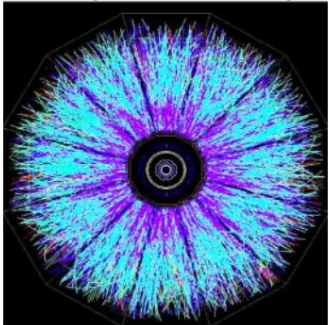
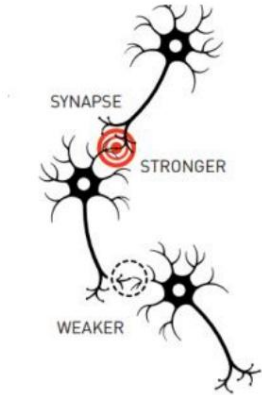


Fig. 3. The image of the polarized space of a gold ion with Faraday lines of force, diagnosed experimentally in [26].

The works [24,25,27] present the results of applying the presented theory of physical vacuum to solving various scientific and technical problems.

6. Electrodynamic impulses in axons

The above material allows us to formulate the mechanics in a reasonable manner.
transmission of electrodynamic impulses in axons - long cylindrical



processes of nerve cells (Fig. 4).
At the end of the axon there is a synaptic
an ending that contacts a target cell. Together with the
postsynaptic membrane of the target cell, the synaptic
ending forms a synapse.

Fig. 4. Axons and synapses
endings in contact with the target cell (diagram and
photograph).

The transmission of the nerve impulse occurs from the cell body to the axon, and then the generated action potential from the initial segment of the axon is transmitted back through the synapse to the cell. Here, in order to avoid contradictions (like the "4/3 problem"), longitudinal-transverse disturbances should be considered based on Maxwell's potential and solenoidal displacement currents.

It is necessary to specially emphasize the main role of the propagation of longitudinal electrodynamic impulses in biological nervous systems and technical neural networks.

7. Gravity Lucretius

The part of Lucretius' poem that deals with questions is very interesting.
gravity - attraction. For Lucretius, the body is unthinkable without gravity:

"For everything pressing downwards is a sign of the body"

However, the fall of bodies does not at all follow only from the properties of the body itself; another body is needed for this. With amazing insight, from purely speculative ideas, Lucretius, ahead of Galileo by millennia, asserts that bodies in a vacuum must fall at the same speed regardless of weight:

***"Never anywhere is capable of anything
The thing to hold the void and appear as some kind of support,
By nature, constantly giving in to everything.
Therefore, everything must, rushing through the void without obstacles,
Have equal speed despite differences in weight"***

A brilliant conclusion in comparison with the thesis of the "child prodigies" of the early 20th century about gravity as the curvature of space. S.I. Vavilov in his report [1] describes in detail the issues of gravity, as presented by Lucretius, and at the end of the report, summing up the poem as a whole, states: "Comparing the physics of our days with the physics of Lucretius and at the same time properly abstracting from the details, comparing only the main thing in the most abstract form, we undoubtedly recognize much in common, and in the most important thing."

In full agreement with the statements of the poem and the experimental data available today, the physical vacuum = the emptiness of Lucretius -
is considered below as a carrier of an electrodynamic force field, the potential of which in an unperturbed state is taken to be equal to zero. Its materialization is performed using Faraday's lines of force. The specified properties of materialized lines of force in a physical vacuum are in full accordance with Maxwell's equations. In this case, gravitational interaction is considered as a special case of this force field.

The basic principle of the presented work is the extremely small difference in the distribution of potentials around the "point" electric charges in the center of the proton and electron. Such an extremely small difference in the distribution of 431

electrical potentials near centers of different diameters (and masses) of the proton and electron leads to the presence of a small total uncompensated electrostatic charge of a body of baryonic matter, which by definition is directly proportional to its baryonic mass. The presence of this charge generates a force interaction in the external space surrounding the body in question (and, above all, in the "physical vacuum" of this space). The gravitational process is described by the mutual action of electrostatic forces determined by the gradient of their potential and the pressure gradient of the environment. This force field is modeled by the unified Hooke-Newton-Coulomb law in the form of the quasilinear Poisson-Boltzmann equation for the potential φ of a stationary force field [32,33]

(7.1)

Here the parameter $D = \sqrt{\epsilon_0 \epsilon k T / n q^2}$ is the Debye screening radius, which contains only two universal constants $\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 / (\text{N m}^2)$ is the vacuum permittivity and the Boltzmann constant k . Three parameters included in D characterize the state of the medium under study: temperature T (in degrees Kelvin), particle concentration n (in $1/\text{m}^3$), and the characteristic charge q of a particle of the medium (in coulombs). The screening effect is valid for any material medium that is a carrier of a force field. From equation (7.1) beyond the screening limits at distances exceeding D , the traditional inverse-square law for long-range and short-range force fields follows with any predetermined accuracy. Historically, the inverse-square law for the gravitational field was formulated in the 17th century. In particular, in 1679, R. Hooke came to the conclusion that gravity has an inversely proportional dependence on the square of the distance and reported this in a letter to I. Newton, asking him to study this issue in more detail in mathematical terms (which was subsequently done by I. Newton).

In our article we consider the approximation of the mechanics of a continuous medium with its own pressure, the particles of which are also carriers of an elementary charge. In fact, in the approximation of the mechanics of a continuous medium we make a transition similar to the transition from the kinetic equation of L. Boltzmann, which describes short-range effects with the help of a "collisional" term, to the kinetic equation of A.A. Vlasov. In 1938, A.A. Vlasov proposed a model for combining short-range and long-range effects within the framework of the kinetic theory of charged matter. The work contains

typical practical examples.

Using dimensional analysis, we find the gravitational frequency (similar to the known plasma frequency) and the corresponding gravitational time period. Based on these values, we can consider the model of a pulsating Universe. We determine the characteristic value of the gravitational frequency. We note at

this, that such a parameter, often used in cosmology, as the average density of matter in the Universe, at its enormous scales will approach the value $\ddot{y}0$. From the two dimensional parameters G and $\ddot{y}0$, determining the gravitational interaction in our case, using dimensional methods we obtain the gravitational frequency $\ddot{y}g$ and the gravitational period Tg of our Metagalaxy. We have

$$T_g = \frac{1}{\ddot{y}g} = \frac{1}{\ddot{y}} \sqrt{\frac{4}{G \rho_0}}$$

In the case where the speed of light c in a vacuum is also taken to determine the process constant, then we obtain the characteristic linear size of the Metagalaxy.

Let us give a typical example of solutions of equation (7.1) in the presence of a non-zero right-hand side and when it is equal to zero. Figure 5 shows two accurate solutions of equation (7.1) for the spherically symmetric case in the interval $0.1 < r < 1.0$ with a given dimensionless value of the potential $\ddot{y} = 1$ at $r = 0.1$ and $\ddot{y} = 0.1$ at $r = 1.0$ (blue line) and a solution of equation (7.1) with a zero right-hand side when $\ddot{y} = 1/r$ (red line).

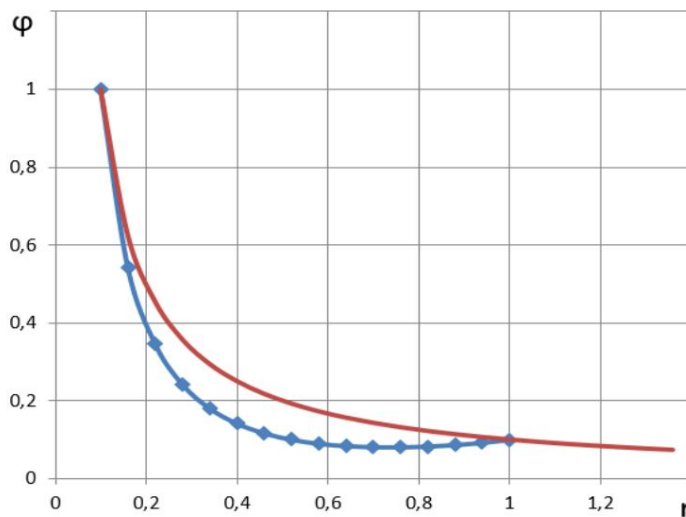


Fig. 5. Two solutions (7.1) of the equation for the spherical case for $0.1 < r < 1.0$ with the value $\ddot{y} = 1$ for $r = 0.1$ and $\ddot{y} = 0.1$ for $r = 1.0$ (line 1) and with a zero right-hand side $\ddot{y} = 1/r$ (line 2).

The solution presented in Fig. 5 models, in spherical particular, the potential outer shell of distribution for the the gold ion presented in Fig. 3.

In [24] an example of calculation using equation (7.1) of the spherically symmetric field of the Earth's gravitational potential is shown. In terms of short-range action, modeling of polarized spaces of an electron and a proton using equation (7.1) is performed in [25].

8. Lucretius' "potestas" are the inner energy

In the original text of the poem, Lucretius uses and explains the meaning of the Latin term "potestas", which literally means "inner power", and can thus be interpreted from a modern perspective as

energy (not only as "potential energy", but also as "internal power", released, in particular, as a result of CN).

For example, Lucretius uses the word potestas when analyzing the origins of the movement - "the beginning of movement is born in the heart":

***"And therefore we must admit that in the movement of the rudiments
Besides the jolts or heaviness, there is another reason,
It is the one from whom the "potestas" was innate to us***

Thus, in addition to mechanical causality, there are other, deeper laws of the formation of things. Obviously, due to the presence of a strictly materialistic view in Lucretius' philosophy, he basically has a correct idea not only of space, time and movement, but also of the presence of

"inner power" (energy) in the formations of things and correctly understands that they are a characteristic property of their existence.

At the same time, modern field theory does not consider the presence of potential energy in propagating electromagnetic waves and the law of conservation of energy and its flow is not fulfilled in this theory.

The material of the presented article allows us to explain the nature of "strange" radiation, various types of tracks, superluminal motion of matter and soliton clots of light [27-33]. Exact analytical solutions for solitons and ball lightning are given, in particular, in [33].

Conclusion

The absence of a mathematical apparatus for describing the physical and biological processes of the "nature of things" in ancient times did not allow Lucretius to support his scientific positions with appropriate formulas and mathematical proofs. In this article, this gap is filled in quite clearly. The presented article contains a derivation of an extended system of Maxwell's equations with solutions in the form of longitudinal-transverse disturbances. The resulting system of Maxwell's equations does not have the paradoxical properties inherent in modern theoretical physics. The presence of longitudinal compression waves and nonlinear solutions such as isolated solitary waves of stationary form - solitons predetermines the materialized consideration of the elastic physical vacuum in the form of a model of a gaseous easily mobile medium - a carrier of electromagnetic interaction in the presence of a finite characteristic temperature $T_0 = 2.735 \text{ K}$ and a given estimate of the average density of our Metagalaxy $\rho_0 \sim 10^{-26} \text{ kg / m}^3$.

Electromagnetic phenomena are based on an electric field that propagates between oppositely charged bodies (in the form of materialized Faraday lines of force). The magnetic field is a non-stationary vortex component of the electric field, which manifests itself only as a change in the vector potential of electrical tension over time. In connection with this effect, it can be argued that magnetic

monopoly does not exist.

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**The mechanical and mathematical substantiation
of the scientific provisions of the poem
"De Rerum Natura" by Titus Lucretius Karus**

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The famous poem "De Rerum Natura" by the ancient Roman scientist-philosopher Titus Lucretius Karus, published in 1st BC, experimentally substantiates the scientific concepts of the materialistic direction of the ancient Greek natural philosophy of Leucippus-Democritus-Epicurus and reasonably introduces the concepts of atomism of matter and materialized ether. However, the absence in those distant times of a developed mechanical and mathematical apparatus for describing the physical-biological processes of the "nature of things" did not allow the author to back up his scientific positions with appropriate formulas and mathematical proofs. Today, this gap can be filled quite clearly, which is what the content of the work is devoted to. In particular, the fundamental foundations of the field theory as a materialized physical vacuum carrier of weak electromagnetic longitudinal-transverse perturbations and the theory of gravity are considered. The classical methodology of a gaseous continuous medium in the boundary layer approximation is used, an extended system of Maxwell equations is obtained and its integration by the method of characteristics is carried out. The physics of "strange" radiation, various kinds of tracks, superluminal motion of matter and soliton clusters of light are explained. Precise analytical solutions for solitons and ball lightning are presented. Mathematical modeling of the ancient concept of the human soul and mind in the form of longitudinal-transverse displacements and stresses (Maxwell displacement currents) is also presented. In the original original text of the poem, Lucretius uses and explains the meaning of the Latin term "potestas", which literally means "inner power", and thus can be interpreted from modern positions not only as "potential energy", but also as internal energy released as a result of LENR.

Resolution

on the work of the conference of the RKHTY and SM-28

1. The next Russian Conference on Cold Transmutation of Nuclear Elements and Ball Lightning Physics (RCCTN and BL-28) was held in Moscow from September 30 to October 4, 2024. The conference was held online via the ZOOM system.
2. The number of conference participants at each session is about 50 people. The number of scientific reports made is 40. Among them, 8 reports from near and far abroad. 5 round tables were held with discussions of the reports heard.
3. Scientific reports were devoted to the physics of LENR and SM, the study of other little-studied natural phenomena, as well as the interaction of electromagnetic and other fields with matter, in particular:
 - experimental results obtained on different types of LENR reactors;
 - diagnostic methods for studying various radiations from LENR reactors;
 - analysis of the composition of chemical elements in such reactors;
 - study of thermal processes in LENR reactors;
 - theoretical models of LENR;
 - theoretical models of SM;
 - analysis of SM observations in 2022-2024;
 - obtaining laboratory analogues of SM;
 - possible connections between SM and LENR.
4. To recognize the work of the conference as successful and productive.
5. Continue experimental and theoretical research in the field of physics LENR.
6. Recommend that the Russian government and other interested organizations, including the Russian Academy of Sciences and Minatom, pay attention to LENR as a path to clean energy. Pay attention to the need for adequate funding for theoretical and experimental work related to LENR research and the practical implementation of achievements. We must not allow ourselves to lag behind foreign work in the field of LENR, which has recently received increasing government support (ARPA-E, Clean HME, Clean Planet and others).
7. Continue interaction with international organizations in the field of LENR physics (ISCMNS, SFSNMC, IWAHLM, MFMP, etc.). Take into account and adopt

attention to the important findings and conclusions made at the latest IWAHL and ICCF conferences for the development of research in the Russian Federation.

8. Pay special attention to solving the following urgent problems:

- use of modern diagnostic equipment for studying physics LENR and related phenomena.
 - study of radiation near LENR reactors, in particular soft X-ray and neutron-like radiation.
 - study of the elemental and isotopic composition of LENR reactor products.
 - development of detectors for recording various types of radiation from LENR reactors and research into their physical nature.
 - study of the biological action of LENR reactors. Development of methods protecting researchers from their possible harmful effects.
 - study of the energy balance and stability of LENR reactors in depending on the design, pressure, temperature, fuel composition, parameters power supply, etc.
 - development of theoretical models that take into account the entire range of LENR properties.
 - collection and analysis of observational data on ball lightning.
 - study of the physics of long-lived energy-intensive plasmoids created in the laboratory for modeling the SM.
 - continue the comparison of existing theoretical models of SM based on the analysis of the observational data bank.
9. Express gratitude to the foreign LENR researchers who took part in the conference in our difficult times.
10. Conduct a competition "Best report at the conference of the Russian Chemical Technology Federation and the Russian Science Ministry -28"
11. Recommend for publication in the journals "RENSIT", "Vestnik RAEN", J. Condensed Matter Nucl. Sci. articles based on the most important papers presented at this conference.
12. Publish a collection of materials from the RKHTYA and SM-28.

Chairman of the RKHTYA and SM -26 A.G. Parkhomov

Members of the Organizing Committee L.B. Boldyreva, V.L. Bychkov, V.N. Zatelepin, A.I. Klimov, A.A. Prosvirnov

Scientific publication

**28th RUSSIAN CONFERENCE ON COLD TRANSMUTATION OF NUCLEI OF
CHEMICAL ELEMENTS AND BALL LIGHTNING**

**PROBLEMS OF COLD TRANSMUTATION OF NUCLEI OF
CHEMICAL ELEMENTS AND BALL LIGHTNING**

Moscow, September 30 - October 4, 2024

CONFERENCE PROCEEDINGS

Editor-in-chief A.G.Parhomov

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