UNIFIED THEORY OF THE FIELD, INDUCED BY MOVING ELECTRICALLY CHARGED MEDIUM, [1]

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Earlier [2], [3], on the gyroscopic model of the closed contours with currents, the author, independently of Heaviside, has substantiated the post-Newton theory of gravitation in the form of Maxwell electrodynamic equations. This article is dedicated to association into the unified field theory of the post-Newton theory of gravitation of Heaviside-Potjekhin and Maxwell theory of electromagnetic field. This theory, in particular, explains the unsolved for today problem of the field of the revolving electrically charged massive bodies, for example, of planets [4]. In the historical sense the Maxwell-Heaviside problem of the negative energy of gravitational field is considered.

Key words: gravitation; gyro; electrodynamics; unified field's theory.

1. On the way to the unified theory of electromagnetic and gravitational interactions should be, first of all, modified Maxwell electrodynamic equations, taking into account the fact, that electric charges do not exist without masses. The motion of electric charge with a certain speed always corresponds to the motion with the same speed of the mass linked to this charge. In order to reflect the role of mass of charges in Maxwell electrodynamic equations, let us examine a certain mechanical process, which accompanies electrodynamic interaction of bodies, for example, gyro precession.

Magnetic interaction of bodies is completely manifested at interaction of the closed contours with the electric currents. Let ring-shaped contour 2, in which the electric charges of density ρ_q with their mass density ρ_m^* circulate with the speed $\bar{v}$, rests in the dynamic inertial reference system. Current of charges in this contour induces field with magnetic induction $\bar{B}$ and electrical tension $\bar{E}$. Let us introduce into this field another ring-shaped contour 1 of radius R, in which the electric charges of density δ_q and their mass density δ_m^*, similar to those of contour 2, circulate with the speed $\bar{u}$. The masses of charges that circulate in contour 1, form gyrorotor revolving with angular velocity $\omega_0 = u/R$. Experience shows, that as a result of the magnetic field $\bar{B}$ action on the charges of the contour 1, this contour constrains itself to precess with the certain angular velocity $\bar{\omega}_q$. In this case the gyroscopic moment appears

$$\bar{M}^g = J_0 \bar{\omega}_0 \times \bar{\omega}_q, \tag{1}$$

where J_0 - mass inertia moment of the ring 1. Expression (1) is reduced to the form [3]:

$$M^g = 2\frac{\delta_m^*}{\delta_q} \omega_q I_q S \sin\alpha, \tag{2}$$

where I_q - the strength of electric current in contour 1, S - area, embraced by this contour.

Let us designate

$$\bar{B} = 2\frac{\delta_m^*}{\delta_q} \bar{\omega}_q, \tag{3}$$

then (2) is taking the form

$$M^g = BIS \sin\alpha, \tag{4}$$

which coincides with expression for the torque, known in the electrodynamics, acting on the closed contour with the current in the magnetic field. In that case expression (3) correlates between the magnetic field vector $\overline{B}$ and the angular velocity vector of precession $\overline{\omega}_q$ of the closed contour with the current in this field. Reflecting this interrelation, we will name vector $\overline{\omega}_q$ the vector of the vortex induction of the electromagnetic field $\overline{EB}$.

The total Lorentz force, which acts onto the charge of contour 1 in the electromagnetic field,

$$\overline{F}_q = \delta_q(\overline{E} + \overline{u} \times \overline{B}), \tag{5}$$

with account of (3), can be presented in the form

$$\overline{F}_q = \delta_q(\overline{E} + 2\frac{\delta_m^*}{\delta_q}\overline{u} \times \overline{\omega}_q) = \delta_m^*(\frac{\delta_q}{\delta_m^*}\overline{E} + 2\overline{u} \times \omega_q). \tag{6}$$

Let us designate

$$\overline{g}_q = \frac{\delta_q}{\delta_m^*}\overline{E}, \tag{7}$$

where $\overline{g}_q$ has the dimensionality of acceleration and is the gravitational strength of electrodynamic field. Then (6) is taking the form

$$\overline{F}_q = \delta_m^*(\overline{g}_q + 2\overline{u} \times \overline{\omega}_q) = \delta_m^* \overline{\Im}_q, \tag{8}$$

where $\overline{\Im}_q$ - complete gravitational strength of the electrodynamic field $\overline{EB}$

$$\overline{\Im}_q = \overline{g}_q + 2\overline{u} \times \overline{\omega}_q. \tag{9}$$

Let us note that the force cannot be exerted to the electric charge, the force is applied to the mass of this charge. Thus, on one side, one and the same force in the electromagnetic field, applied to the mass of electric charge, can be represented as electrodynamic Lorentz force (5), on the other side as gravitational force (8) in the gravitational field with the tension $\overline{\Im}_q$.

Field $\overline{EB}$ is determined by the system of Maxwell electrodynamic equations

$$div\overline{E} = \frac{1}{\varepsilon_0}\rho_q, \qquad rot\overline{E} = -\frac{\partial \overline{B}}{\partial t}; \tag{10}$$

$$div\overline{B} = 0, \qquad rot\overline{B} = \mu_0 \rho_q \overline{v} + \frac{1}{c^2}\frac{\partial \overline{E}}{\partial t}, \tag{11}$$

which, with account of (3), (7), take the form

$$div\,\overline{g}_q = \frac{1}{\varepsilon_0}\frac{\rho_q \delta_q}{\delta_m^*}, \qquad rot\,\overline{g}_q = -2\frac{\partial \overline{\omega}_q}{\partial t}; \tag{12}$$

$$div\overline{\omega}_q = 0, \qquad rot\overline{\omega}_q = \frac{1}{2}\mu_0\frac{\rho_q \delta_q}{\delta_m^*}\overline{v} + \frac{1}{2c^2}\frac{\partial \overline{g}_q}{\partial t}, \tag{13}$$

Equations (12), (13) are the united-field form of Maxwell electrodynamic equations (10), (11). Transition from one of the forms of writing down the equations of electrodynamics to another is accomplished with the aid of the relationships (3), (7).

For that very special case, when $\rho_q = \delta_q$ and $\rho_m^* = \delta_m^*$, equations (12), (13) take the form

$$div\,\overline{g}_q = \frac{1}{\varepsilon_0}\frac{\rho_q^2}{\rho_m^*}, \qquad rot\,\overline{g}_q = -2\frac{\partial\overline{\omega}_q}{\partial t}; \tag{14}$$

$$div\overline{\omega}_q = 0, \qquad rot\overline{\omega}_q = \frac{1}{2}\mu_0\frac{\rho_q^2}{\rho_m^*} + \frac{1}{2c^2}\frac{\partial\overline{g}_q}{\partial t}, \tag{15}$$

2. Analogously is considered interaction of the closed contours with the gravitational currents [3], taking into account the equivalence principle - the equality of gravitational and inertial masses. Current of charges with density ρ_m in the fixed contour 2 produces field with the gyroscopic induction $\overline{G}$ (analogue of the magnetic induction $\overline{B}$) and gravitational tension $\overline{g}_m$ (analogue of the electrical tension $\overline{E}$). The gyroscopic moment (2), which constrains mobile contour 1 to precess with angular velocity ω_m, is taking the form

$$M^g = 2\omega_m I_m S\sin\alpha, \tag{16}$$

$I_m = \delta_m u$ – strength of gravitational current, δ_m – density of the gravitational charges (mass) of mobile contour.

Let us designate

$$\overline{G} = 2\overline{\omega}_m \tag{17}$$

and we will name $\overline{\omega}_m$ the vector of the vortex induction of gravitational field. Then (16) is taking the form, analogous to (4)

$$M^g = GIS\sin\alpha. \tag{18}$$

The analog of Lorentz force (5) in gravitational dynamics is a Newton-Coriolis force

$$\overline{F}_m = \delta_m(\overline{g}_m + \overline{u}\times\overline{G}), \tag{19}$$

which, taking into consideration (17), can be represented in the form (8)

$$\overline{F}_m = \delta_m(\overline{g}_m + 2\overline{u}\times\overline{\omega}_m) = \delta_m\overline{\Im}_m, \tag{20}$$

where $\overline{\Im}_m$ is, analogously to (9), a complete tension of the gravitational field

$$\overline{\Im}_m = \overline{g}_m + 2\overline{u}\times\overline{\omega}_m. \tag{21}$$

The above-introduced vector $\overline{G}$ with gravitational interactions of bodies plays the same role, as magnetic induction vector $\overline{B}$ at electromagnetic interactions. Taking into account its expression by relationship (17) through the angular velocity of gyro precession, it is named the vector of gyroscopic induction.

The gravitational-gyroscopic $\overline{g}_m\overline{G}$ field of the fixed contour 2 is determined by the system of equations of Heaviside-Potjekhin [2], [3]

$$div\,\overline{g}_m = -\frac{1}{\gamma_0}\rho_m, \qquad rot\,\overline{g}_m = \frac{\partial\overline{G}}{\partial t}; \tag{22}$$

$$div\overline{G} = 0, \qquad rot\overline{G} = g_0\rho_m\overline{v} - \frac{1}{c^2}\frac{\partial\overline{g}_m}{\partial t}, \tag{23}$$

which, considering (17), take the form

$$div\,\bar{g}_m = -\frac{1}{\gamma_0}\rho_m, \qquad rot\,\bar{g}_m = 2\frac{\partial \omega_m}{\partial t}; \tag{24}$$

$$div\omega_m = 0, \qquad rot\bar{\omega}_m = \frac{1}{2}g_0\rho_m\bar{v} - \frac{1}{2c^2}\frac{\partial \bar{g}_m}{\partial t}. \tag{25}$$

Equations (24), (25) are the united-field form of the gravitodynamic equations (22), (23). Transition from one of forms of writing down the equations of gravitodynamics to another is accomplished by relationship (17).

Let us note that in view of the equivalence principle of the gravitational and inert masses of one and the same material particle, the structure of gravitodynamic equations (24), (25) is simpler than that of analogous electrodynamic equations (12), (13). This is a consequence of the fact that in view of the of the equivalence principle of gravitational and inert masses, measured parameters $\bar{g}_m$, $\bar{\omega}_m$ gravitodynamic field (24), (25) do not depend on the density ratio of the gravitational and inertial masses of trial contour, what cannot be said about the parameters $\bar{g}_q$ and $\bar{\omega}_q$ of the field (12), (13).

3. Medium with the density of neutral mass (gravitational charges) ρ_m and the electric charges ρ_q with their mass density ρ_m^*, moving in the dynamic inertial reference system, produces the unified field $\bar{g}\bar{\Omega}$ with the total tension $\bar{\Im}$. The particle with mass m, that moves in this field with the speed $\bar{u}$, undergoes action of the united-field force of Newton- Coriolis

$$\bar{F} = m\bar{\Im} = m(\bar{g} + 2\bar{u}\times\bar{\Omega}), \quad \text{where} \quad \bar{g} = \bar{g}_m + \bar{g}_q; \quad \bar{\Omega} = \bar{\omega}_m + \bar{\omega}_q. \tag{26}$$

Fields of accelerations (tension) $\bar{g}_m$ and the vortex induction $\bar{\omega}_m$ are determined by the modified gravitodynamic Maxwell equations (24), (25) of the moving gravitational charges ρ_m and ρ_m^*. Fields of accelerations (tension) $\bar{g}_q$ and the vortex induction $\bar{\omega}_q$ are determined by the modified electrodynamic Maxwell equations (12), (13) of the moving electric charges ρ_q. As the consequence of these equations, we obtain the wave equations of free fields $\bar{g}$ [m/s^2] and $\bar{\Omega}$ [1/s]

$$\Delta\bar{g} = \frac{1}{c^2}\frac{\partial^2\bar{g}}{\partial t^2}; \qquad \Delta\bar{\Omega} = \frac{1}{c^2}\frac{\partial^2\bar{\Omega}}{\partial t^2}. \tag{27}$$

From the aforesaid it follows, that rotation of the neutral masses of the body having density ρ_m, that induce $\bar{G}$ - field, stipulates an increase in the magnetic field $\bar{B}$ of this body, induced by its electric charges of density ρ_q, by value

$$\Delta\bar{B} = \frac{\delta_m}{\delta_q}\bar{G} \tag{28}$$

so that resulting magnetic field is equal to

$$\bar{B}' = \bar{B} + \frac{\delta_m}{\delta_q}\bar{G} \tag{29}$$

"It seems as if magnetic fields appear at rotation of neutral masses. Neither Maxwell's theory in its initial form, nor Maxwell's theory, generalized in the sense of general relativity theory can predict similar creation of fields". (A. Einstein, 1920)

Tornado - this is the fast-turning hollow massive, electrically charged cylindrical vortex with the sharply designated boundaries of external and internal walls. In its internal cavity one could expect the sufficiently powerful field, induced by the revolving medium of vortex, not only magnetic $\overline{B}$, but also gyroscopic $\overline{G}$, the mechanism of strengthening of which is the same as in ferromagnetic materials for $\overline{B}$ field. This field can be registered by the gyrorotor precession in the cavity of tornado. Conducting this experiment is extremely urgent.

Historical information

The decisive step to the unified field theory was the substantiation of equations of gravitational dynamics in the form of Maxwell electrodynamic equations. Actually, this step was conducted already by the founders of electrodynamics - Maxwell and Heaviside.

Maxwell focuses attention on the analogy of the Newton law of universal gravitation with gravitational interactions of bodies and Coulomb law at interaction of electric charges. And he raises the question [5]: "After tracing to the action of the surrounding medium both the magnetic and the electric attractions and repulsions, and finding them to depend on the inverse square of the distance, we are naturally led to inquire whether the attraction of gravitation, which follows the same law of the distance , is not also traceable to the action of a surrounding medium". Developing this analogy, Maxwell obtains expression for the internal energy of the field, which surrounds two bodies mutually gravitating towards each other

$$W = C - \sum \frac{1}{8\pi} R^2 dV , \qquad (30)$$

where C - positive constant, and draws the conclusion: "Hence, the intrinsic energy of the field of gravitation must therefore be less wherever there is a resultant gravitating force. As energy is essentially positive, it is impossible for any part of space to have negative intrinsic energy. The assumption, therefore, that gravitation arises from the action of the surrounding medium in the way pointed out, leads to the conclusion that every part of this medium possesses, when undisturbed, an enormous intrinsic energy, and that presence of dense bodies influences the medium so as to diminish this energy wherever there is a resultant attraction. As I am unable to understand in what way medium can possess such properties, I cannot go any further in this direction in searching for the cause of gravitation". Heaviside notices this very difficulty, and makes the following conclusion [6]: "It must be confessed that the exhaustion of potential energy from a universal medium is a very unintelligible and mysterious matter. When matter is infinitely widely separated, and the forces are least, the potential energy is at its greatest, and when the potential energy is most exhausted, the forces are most energetic!… But it is merely the exhaustion of potential energy of unknown amount and distribution". Unfortunately, in its subsequent development physics of XXth century deviated from the resolving of this problem.

Actually, any energy by its essence is positive. Really, it is impossible that any part of the physical space (ether, medium, physical space, physical vacuum, background gravitational field) would possess negative internal energy. It's actual, that presence of dense, mutually gravitating towards to each other bodies, influences on the medium towards decrease of this energy - decrease of the constant C in equation (30). But in this case the mutually repellent dense bodies influence on the medium (in accordance with the law of energy conservation and transformation) towards increase of the energy C, which is confirmed at the mutual repulsion of electrically of the similarly charged masses. The fact that each part of this medium, being undisturbed, possesses huge internal energy, is explained by the fact that we are located within the expanding part of the Universe. This expansion is accompanied by an increase in the energy of the background gravitational field. But the nature has no inexhaustible source of energy. Therefore an increase of the field energy in one part of the Universe is compensated by its loss in another part; an increase of the field energy at the mutual repulsion of bodies is compensated by its loss with their mutual gravity and so forth, so that Maxwell formula (30) takes the form

$$W = C \pm \sum \frac{1}{8\pi} R^2 dV\,, \tag{31}$$

the upper sign corresponds to the mutual repulsion of bodies, lower – to the mutual gravity.

The given above maximally clear statements of Maxwell and Heaviside later were distorted, and they became to assign them assertion about the impossibility of existence of the vector theory of gravity in the form of the electrodynamic equations of Maxwell on the assumption, that in this case the internal energy of gravitational field becomes negative. But this is not so. Maxwell only drew attention to this problem. Heaviside saw this problem, but he did not refuse from the possibility of substantiation of the gravitatodynamical equations in the form of Maxwell electrodynamic equations. Adhering to the "successful method, applied by Maxwell at the theoretical reasoning", Heaviside obtains the system of gravitational-dynamical equations, which with accuracy to letter designations coincides with the system of equations (22), (23), rediscovered by Potjekhin independently of Heaviside work. Heaviside's article, owing to a number of reasons, proved to be unknown and forgotten, while the works of Potjekhin were ignored, since in the physics of XX[th] century prevailed the formal mathematical method of substantiation of the Makswell-like equations of gravitational dynamics, which essence [7] and others are as follows. The analogue of the equation

$$div\overline{E} = \frac{1}{\varepsilon_0} \rho_e, \tag{32}$$

in the theory of gravity must be the equation

$$div\overline{g} = -\frac{1}{\gamma_0} \rho_m, \tag{33}$$

i.e., remarks the author of [7] and others, equation (33) can be obtained from equation (32) by redesignation and change of sign in the constant ε_0 and, however, since must be kept the relationship

$$\varepsilon_0 \mu_0 = (-\gamma_0)(-g_0) = c^{-2}, \tag{34}$$

where c is the speed of light, then it is necessary to take "minus" sign also in the gravitational analogue g_0 – the constant μ_0. Consequently, it is asserted that if in Maxwell equations of electrodynamics we redesignate symbols of fields and take in the gravitational analogues of the constants ε_0 and μ_0 the "minus" sign, then we will obtain the appropriate Maxwell-like gravitational-dynamical equations. But this change of signs in the constants ε_0 and μ_0 leads to the erroneous equations of the False Invariant Theory of Gravity (FITG). With this change of signs in the constants ε_0 and μ_0 the field energy in FITG

$$w = -\frac{1}{2}(\varepsilon_0 E^2 + \frac{1}{\mu_0} B^2), \tag{35}$$

really, becomes negative. This is sufficient to reject this substantiation of the gravitational-dynamical equations in the form of Maxwell.

According to Heaviside-Potjekhin, upon transition from the equations of electrodynamics to the appropriate equations of gravitational dynamics, it is necessary to change notations and to replace sign in the gravitational analogue of the vector of the tension of the electric field $\overline{E}$. Sign in the analogue of magnetic induction vector $\overline{B}$ does not change. Change of sign in the vector $\overline{E}$ is obvious, since this corresponds to passage from the mutual repulsion of similar electric charges to the mutual attraction of gravitational masses. Retention of sign in the analogue $\overline{B}$ Heaviside assumes silently, without substantiation. However, Potjekhin presents this substantiation, firstly, on the model presentation of interaction of contours with the gravitational currents [3] and, secondly, by the physically meaningful analysis of the possible variants of combination of fields of attraction and repulsion by the change of signs in the vectors $\overline{E}$ and $\overline{B}$, [2]. In this case, at any combination of signs of vectors $\overline{E}$ and $\overline{B}$, energy of gravitational field remains positive.

Resume.

Electric charge, as an independent material essence, does not exist. Electric charge only reflects one of the possible states of mass, inherent to it, by virtue of which Coulomb law of power interaction of the electrified masses is analogous to the Newton law of universal gravitation of neutral masses.

Masses, moving in the dynamic inertial reference systems, both in the neutral and in the electrically charged state, induce the united gravitational field $\overline{\Im}$, components of which in the first post-Newton approximation satisfy the modified equations of Maxwell.

The energy of field, being always a positive value, diminishes in proportion to the distance from the body, both electrically charged and neutral. In this case, local energy of bodies at their mutual repulsion supplements energy of the background gravitational field and wastes this energy at their mutual gravity. However, in each of these cases, an increase in the kinetic energy of bodies under action of field forces is accompanied by the loss of global energy of the background gravitational field. This concludes the solution of the problem of the field energy, which confused Maxwell and Heaviside.

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The article is published after the author's death