## Physical model of the gravitation

### Idea

*To investigate the possibility of the microscopic matter interaction with the macroscopic matter in the form of the gravitation interaction. To construct mathematical model which agree with the experiments.*

It is known that main models of gravitation are based on the idea suggested by Einstein: gravitation is fundamental physical property of the reality, which forms the space - time. Objects and their interactions are secondary in relation to them. Physical materiality of space and time does not admit in this approach. The space and time are not considered as physical medium. Primacy in a paradigm and physical non materiality of the gravitation is formed the main inconsistent elements of the Einstein model.

Competing models of gravitation either supplement specified, or are based on some new assumptions.

In particular, the relativistic Logunov's model of gravitation acts in a role of the theory of physical fields in Minkowsky space. In this approach it was possible to overcome the singularity of the Einstein's models, to construct the energy-pulse tensor and the conservation laws.

But we have not now the uniform theory of the electromagnetism and gravitation. Many attempts in this direction ( Weil, Kaluza, Eddington…) was destroyed by practice.

Because of this reason we don't have the answer on some fundamental questions:

1. Whether the description of the gravitational phenomena in macro space and time $T^1 \times R^3$, following from macrophysics and consistent with experimenters, is possible?

2. How to receive from the gravitation theory the model of a gravitational charge and its evolution? Whether there are negative and positive gravitational charges? Whether there is a zero gravitational charge?

3. In what sense and how it is possible to coordinate physically and mathematically the theory of the electrodynamical and gravitational phenomena? As far as they are similar and why are various among themselves? As far as the models of electric and gravitational charges can be similar?

4. Does the gravitation have a latent physical material nature, by what it is caused? Whether it is possible to receive a visual image of the physical mechanism of gravitational influence? How to expand and deepen the practical application of the gravitation, how can we operate with gravitation?

5. What physical and mathematical moments are missed in the theory of gravitation? How them to take into account and put into practice?

6. Are there the particles associated with gravitational radiation? To what is their energy equal?

We have new general idea for the unification of the electromagnetism and gravitation. An initial point of the uniform theory analysis of the electromagnetism and gravitation is the idea *of physical analogy between electromagnetism and gravitation*. This problem is natural to objects which have both electric, and a gravitational charge. In particular, in such role act an electron and a proton. The solution of this problem can be useful for solution of the charges problem and for construction the structural theory of the elementary particles.

Start point of our proposal is the realization of the gravitational field as the tensor field depending on some four potential by analogy with electrodynamics.

It will be made mathematically, that both specified models are constructed on same matrix, projective, unimodular group in monomial representation $PSL(4,C)$, named the filling group of physical models.

It is known, that Maxwell electrodynamics has a simple matrix form on pair quaternions, belonging to this group and taking into account anti symmetric structure of the electrodynamics tensor.

However the filling group contains still the three anti quaternions by means of which it is possible to describe symmetric tensors fields. It is known, that law Coulomb for electric charges has the structure similar to the Newton's law for mass charges. We materialize base idea about uniform structure of the electromagnetism and gravitation, having accepted the point of view, that gravitation can be described on the three anti quaternions of the filling group of physical models.

We will show simple connection between electrodynamics and gravitation. Let's show, that the opportunity of required association follows from electrodynamics. We shall consider the Faradee-Amper equations:

$$Q_{kmn} = \partial_k F_{mn} + \partial_m F_{nk} + \partial_n F_{km} = 0 = \partial_{[k} F_{mn]}.$$

Let's set

$$F_{mn} = \partial_m A_n - \partial_n A_m.$$

We receive

$$\partial_k(\partial_m A_n - \partial_n A_m) + \partial_m(\partial_n A_k - \partial_k A_n) + \partial_n(\partial_k A_m - \partial_m A_k) \equiv 0.$$

We will use the differentiation of these equations and add the sum which is equal to zero. We will receive the equations

$$\partial_l(\partial_k(\partial_m A_n - \partial_n A_m) + \partial_m(\partial_n A_k - \partial_k A_n) + \partial_n(\partial_k A_m - \partial_m A_k)) + \partial_k\partial_m\partial_n A_l - \partial_k\partial_m\partial_n A_l \equiv 0.$$

Then they can be written down in other form:

$$\partial_k\partial_m(\partial_n A_l - \partial_l A_n) + \partial_m\partial_n(\partial_l A_k - \partial_k A_l) + \partial_n\partial_l(\partial_k A_m - \partial_m A_k) + \partial_l\partial_k(\partial_m A_n - \partial_n A_m) \equiv 0.$$

On a basis of the tensor $F_{nm}$ we will receive the cyclic equations of a kind

$$\partial_k \partial_m F_{nl} + \partial_m \partial_n F_{lk} + \partial_n \partial_l F_{km} + \partial_l \partial_k F_{mn} = 0.$$

Let's rearrange indexes in this cyclic equation, taking into account the antisymmetry of the tensor, describing the electromagnetic phenomena. We shall write down the equations in a general form

$$\partial_m (\partial_k \Phi_{nl} - \partial_n \Phi_{kl}) + \partial_l (\partial_n \Phi_{km} - \partial_k \Phi_{nm}) = 0.$$

Symmetric tensor

$$G_{mn} = \partial_m B_n + \partial_n B_m$$

gives the solution of these equations.

*We show the possibility of the connection between electrodynamics and gravitation.*

Now we have constructed new tensor theory of the gravitation:

$$\gamma^{kl} \partial_k \partial_l \tilde{\sigma}_{ps} = k\tilde{\tilde{T}}_{ps} + \varepsilon \tilde{\sigma}_{ps}, \gamma^{kl} \partial_k \tilde{\sigma}_{ls} = \chi_s,$$

$$2\gamma^{lk} \partial_l \tilde{\sigma}_{ps} \partial_k \widehat{u}^s + \tilde{\sigma}_{ps} \gamma^{kl} \partial_k \partial_l \widehat{u}^s = (k\tilde{\tilde{T}}_{ps} + \varepsilon \tilde{\sigma}_{ps}) \widehat{u}^s,$$

$$\tilde{\sigma}_{ls} \gamma^{kl} \partial_k \widehat{u}^s = \tilde{\chi}_s \widehat{u}^s.$$

The suggested model of the gravitation gives in special case the Einstein's gravitation theory in the Logunov's form:

$$\gamma^{kl} \partial_k \partial_l \tilde{\sigma}_{ps} = k\tilde{T}_{ps} + \varepsilon \tilde{\sigma}_{ps}, \gamma^{kl} \partial_k \tilde{\sigma}_{ls} = \chi_s.$$

This model we can use for the analyze of the Sun dynamics. In this case we can calculate the Sun Activity and Sun Energy, using the transformation of the thin matter into light, neutrino, magnetic fields. We can obtain the mechanism of such transformation, which allows to create new technical devices for the direct use of the gravitation energy.

## Mathematical aspects

We will accept the point of view that a "sea" of the thin matter there is in which physical bodies "are float". We will describe the influence of the thin matter on the ordinary matter by the four-potential $B_k = \sigma_{kp} u^p$. We will interpret $\sigma_{kp} = \frac{1}{\sqrt{g}} \hat{\sigma}_{kp}$ as the pressure tensor. Let's set

$$\hat{\sigma}_{kp} = a\left( \frac{\partial u_k}{\partial x^p} + \frac{\partial u_p}{\partial x^k} \right).$$

Then $\partial_i \hat{\sigma}^{hi} = \hat{f}^h$ is the force operating on volume. The components $u^p$ give the four-velocity of thin matter. We will characterize the influence of a thin matter on the ordinary matter by symmetric tensor

$$\varphi_{kl} = \partial_k B_l + \partial_l B_k .$$

It is easy to show, that it is the solution of the equations

$$\partial_k \partial_l \varphi_{ps} - \partial_l \partial_p \varphi_{sk} + \partial_p \partial_s \varphi_{kl} - \partial_s \partial_k \varphi_{lp} = \partial_{(k} \partial_l \varphi_{ps)} = 0.$$

Let's enter tensor $\gamma^{ik} = diag(1,1,1,1)$ and tensor

$$\varphi^{ij} = \gamma^{ik} \gamma^{jl} \varphi_{kl} .$$

Let's consider the conservation law

$$\partial_i \varphi^{ij} = s^j .$$

From this assumption the equations follow

$$\gamma^{kl} \partial_k \partial_l B_p = s_p , \gamma^{kl} \partial_k B_l = 0.$$

Let's express four-potential of the gravitation dynamics $B_p(g)$ in four-velocity pramatter $u^s$ and the symmetric second rank tensor $\sigma_{ps}, \sigma = \det|\sigma_{ps}|$. We will set

$$B_p = \sigma_{ps} \sqrt{-\sigma} \frac{u^s}{\sqrt{-\sigma}} = \tilde{\sigma}_{ps} \hat{u}^s .$$

Then

$$\gamma^{kl} \partial_k \partial_l B_p = \gamma^{kl} \partial_k \partial_l (\tilde{\sigma}_{ps} \hat{u}^s) = (\gamma^{kl} \partial_k \partial_l \tilde{\sigma}_{ps}) \hat{u}^s + 2\gamma^{lk} \partial_l \tilde{\sigma}_{ps} \partial_k \hat{u}^s + \tilde{\sigma}_{ps} \gamma^{kl} \partial_k \partial_l \hat{u}^s = s_p = -\kappa_{ps} \hat{u}^s .$$

Let's set the pramatter movement by the condition

$$\tilde{\sigma}_{ps} \gamma^{kl} \partial_k \partial_l \hat{u}^s + 2\gamma^{lk} \partial_l \tilde{\sigma}_{ps} \partial_k \hat{u}^s = (k\tilde{T}_{ps} + \varepsilon \tilde{\sigma}_{ps}) \hat{u}^s .$$

Here $\tilde{T}_{ps}$ is the energy-impulse tensor of the matter. We obtain

$$\gamma^{kl} \partial_k \partial_l \tilde{\sigma}_{ps} = k\tilde{T}_{ps} + \varepsilon \tilde{\sigma}_{ps} + \kappa_{ps} , \gamma^{kl} \partial_k \tilde{\sigma}_{ls} = \chi_s ,$$

$$2\gamma^{lk} \partial_l \tilde{\sigma}_{ps} \partial_k \hat{u}^s + \tilde{\sigma}_{ps} \gamma^{kl} \partial_k \partial_l \hat{u}^s = (k\tilde{T}_{ps} + \varepsilon \tilde{\sigma}_{ps}) \hat{u}^s ,$$

$$\tilde{\sigma}_{ls} \gamma^{kl} \partial_k \hat{u}^s = \tilde{\chi}_s \hat{u}^s .$$

We have the Einstein gravitation model in Logunov’s form and the equations which characterizes the behavior of a thin matter. The situation becomes much more complex, if instead of the tensor $\gamma^{ij}$, according to the electrodynamics model, the tensor $\Omega^{ij} = a\gamma^{ij} + bu^i u^j$ we will use. If we use the condition $\nabla_k \Omega^{kl} = 0$, we have equations with covariant derivatives

$$\Omega^{kl} \nabla_k \nabla_l B_p = s_p , \Omega^{kl} \nabla_k B_l = 0.$$

## Phenomenological model

Let's accept the assumption that the density of a thin matter increases in process of the removal from the bodies concerning the ordinary matter. Then, on the one hand, it can be much enough between Galaxies. In this case it is possible to expect the effect of pushing apart of Galaxies. Really, it is experimentally observed in astrophysics since 1998. Let's consider, on the other hand, the fact of an attraction of weight bodies at a short distance. Let the weight body $M$ is located on distance $r$ from the weight body $m$.

Let's accept assumptions:

the density of a thin matter is coordinated with the mass of the bodies,

the density of a thin matter increases in process of removal from massive bodies.

We will coordinate both assumptions by the formula:

$$n = a\sqrt{M}\left(\ln(r + r_0) + \frac{b}{r + r_b} + \frac{c}{(r + r_c)^2}\right).$$

The first term acts in a role of the main member in which size $r_0$ is a priori necessary to avoid non physical singularity. Other terms express, accordingly, the influence of "longitudinal" and "cross-section" power lines formed of a thin matter outside of a massive body. Sizes $b, c$ can be small and they are not obliged to be constants. They can be subordinated to the independent dynamic equations considering dynamics of power lines.

Let's accept expression for the force operating between bodies in the form

$$F = -\alpha m\left(\frac{dn}{dr}\right)^2.$$

We obtain the formula

$$F = -\alpha a^2 mM\left(\frac{1}{(r + r_0)} - \frac{b}{(r + r_b)^2} - \frac{2c}{(r + r_c)^3}\right)^2.$$

The obtained law contains the singularity law of the central Newton forces for the description of the planets movement

$$F = \gamma\frac{mM}{r^2}.$$