

Hypothesis On Gravitation

Anatoly Vasil'evich Rykov
rykov@uipe-ras.scgis.ru

Institute of Earth Physics
Russian Academy of Science, Moscow

The nature of gravitation and inertia remains unknown although its effects were first described mathematically by Isaac Newton in 1687. In The 20th century, A. Einstein created a geometric model of gravitation (General Relativity), describing it as a curvature of space in the presence of gravitational masses. This model was presumed justified in a number of astrophysical observations, convincing many physicists that GR is self-sufficient and the subject required no further study. Since the basis of the model is the geometric, a search for a **physical** model of gravity commenced, resulting in many alternative theories.

This paper offers a hypothesis about the physical nature of gravity. It requires reference to a physical vacuum filled with "virtual" particles and antiparticles (Dirac) forming a fluctuating vacuum which in Planck time ($f.3905634 \times 10^{-44}$) creates physical pairs of particles and antiparticles. The term "physical vacuum" appears to be contradictory and will be referred to as the **environment**.

It is known, that photons with 1,02 MeV energy have the ability to turn into an electron–positron pair, giving a photon pulse to any extraneous particle. Laws of conservation of energy and a charge have allowed us to make the assumption that the environment generates electrons and positrons, transforming "virtual" particles into real. Accordingly, the environment should consist of massless elementary charges, (+) and (–). The readiness to create mass indicates an unknown mass-magnetic component. This assumption, (hypothesis #1) is based on the following physical phenomena:

1. Transformation of photons into particles and antiparticles.
2. Energy does not form mass but is necessary for its creation.
3. In physics the question as to what is the carrier of streams of magnetic induction is not clear. All magnetic phenomena, whose nature remains unknown, are realized by means of the magnetic environment.
4. The constancy of the speed of light, independent of movement of source and receiver, can only be due to the environments. An analogy is the speed of the elastic waves propagating in solid, liquid and gaseous environments.
5. Electrical **E** and magnetic **H** of EMW intensity in vacuo are in phase. At the point of change of **E** and **H**, signs simultaneously turn into 0. This contradicts the law of conservation of energy. The contradiction is eliminated if there is an exchange of EMW energy with the environment in which it propagates.

The equation of energy for a photon and pairs a electron – positron:

$$h\nu_{\gamma\delta} = e_0 E \Delta r_{\gamma\delta}$$

$$w = \xi \frac{e_0^2}{r_e} = 2\pi\alpha^{-1} e_0^2 r_q \nu_{\gamma\delta} = 1,6493 \cdot 10^{-13} [J] \quad (1)$$

Where

\hbar – Planck's constant,

$\nu_{r\delta} = 2,4892126289 \cdot 10^{20} [Hz]$ – Frequency of photon at the "red border" at which an electron – positron pair are formed,

$e_0 = \pm 1,60217733 \cdot 10^{-19} [a.s]$ – An elementary charge,

$E = \xi \frac{e_0 \alpha^{-1}}{r_e^2}$ – Electric intensity of the environment,

$\xi = 8,98755179 \cdot 10^9 [a^{-2} m^3 kg \cdot s^{-4}]$ – An electric constant of the environment (return size of electric permittivity of vacuum),

$\alpha^{-1} = 137,035999$ – Return size of fine structure constant,

$r_q = \sqrt{\xi/\eta} = 29,979224 [Om]$ – A root square from the relation of electric and magnetic constants of the environment,

$\eta = 1 \cdot 10^7$ – Return size of magnetic permeability of the vacuum,

$\Delta r_{r\delta} = 1,020726874 \cdot 10^{-17} [m]$ – Limiting deformation of distance $r_e = 1,398763188 \cdot 10^{-15} [m]$ between charges influenced by a photon with "red border" frequency. The specified distances are determined by equation (1).

Electric elasticity b of the environment:

$$f = b \Delta r_{r\delta} = \xi \frac{e_0^2}{r_e^2} \quad b = 1,155406 \cdot 10^{19} [kg \cdot s^{-2}] \quad (2)$$

The structure of the environment has the electric charges forming a crystal, and the distributed mass as a magnetic-mass continuum. We shall name environment as zero - substance or 0S.

The 0S solves many theoretical problems. Hypothesis #2 is necessary for determining the nature of gravity. We shall assume that within the 0S is the source of gravity. It is necessary that the structure of 0S be slightly charged instead of neutral as accepted in physics. It is sufficient if elementary charges (+) and (–) differ by a very small value. Then the attraction of bodies will be carried out by polarization of the environment on the part of material bodies under the rough schematic:

Coulomb attraction (gravity) at the presence of material bodies

$$(- + \text{body1} +) (- + - + - \text{0S} - + - + -) (+ \text{body2} + -),$$

Coulomb self–repulsion (antigravity), in absence of bodies or at great distances between bodies

(---- 0S ----).

The inequality of charges is evidently shown by the zero sum of the difference in charge numbers: (-) is more than (+). **Antigravity is shown as the expansion of the universe.**

The gravitational electric charge of any mass is formulated:

$$Q = \rho M, \text{ where } \rho = e_0 \sqrt{\frac{2\pi G}{ch\alpha}} = \sqrt{\frac{G}{\xi}} = 8,61648635 \cdot 10^{-11} [\text{a} \cdot \text{s} \cdot \text{kg}^{-1}] \quad (3)$$

$$g_{earth} = \sqrt{G\xi} \frac{Q}{R_{earth}^2} = 9,82 [\text{m} / \text{s}^2]$$

Acceleration of gravity for Earth in terms of electric forces provides Interaction of bodies with the 0S is carried out at the level of electrons and nuclei of substances. Gravity also begins with electrons and nuclei, being integrated, finally, in masses of macrobodies. Generally, acceleration from gravity is determined by:

$$g = 4\pi\sqrt{G\xi} S (\Delta r_g)^2 [\text{m} \cdot \text{s}^{-2}], \quad (4)$$

Where

$G = 6,67259 \cdot 10^{-11} [\text{m}^3 \text{kg}^{-1} \text{s}^{-2}]$ – Gravitational constant,

$S = \frac{e_0 \alpha^{-2}}{4\pi r_e^4} = 6,254509 \cdot 10^{43} [\text{a} \cdot \text{s} \cdot \text{m}^{-4}]$ – Factor of 0S polarization.

Calculating the maximal acceleration on (4), appropriate to the maximal deformation, Δr_{rb} :

$$g_{max} = 6,3409 \cdot 10^{10} [\text{m} \cdot \text{s}^{-2}], \quad (5)$$

The maximal acceleration results in the destruction of 0S structure, formation of electron-positron pairs and to conditions on the border of black holes in space.

The force of electroelastic deformation may be determined by the maximal acceleration and the unknown mass, m_x :

$$b \Delta r_{rb} = b \sqrt{\frac{g_{max}}{4\pi S \sqrt{G\xi}}} = g_{max} m_x \quad (6)$$

Equation (6) provides the unknown mass and also, $m_x = \sqrt{\alpha} m_{Pl} = 1,859459 \cdot 10^{-9} [\text{kg}]$, where m_{Pl} – Planck's mass. We obtain $e_0 = \rho m_x = 1,602177 \cdot 10^{-11} [\text{a} \cdot \text{s}]$ – value of the electron charge. Mass m_x provides details of

the gravitational mechanism through the presence of a gravitational charge. We may now calculate the number of electron-positron pairs forming OS dipoles that would be included in this mass:

$$n = \frac{m_x}{m_e} = 2,041257 \cdot 10^{21} [\text{pieces}]$$

For example, the charge of the electron surpasses the charge of a positron by approximately 10^{21} power -

$$\Delta e = \frac{e_o}{n} = 7,84896966 \cdot 10^{-41} [a \cdot s]$$

. It corresponds to the minimal gravitational charge of an electron or a positron mass, i.e. $e_g = \rho m_e = 7,8897 \cdot 10^{-41} [a \cdot s]$. The inadvertently discovered connections in the values of $m_x, m_{pl}, m_e, \rho, e_o$ are surprising and indirectly support the hypothesis. m_e is the electron mass.

The law of Newtonian gravitation in terms of polarization of the environment is supported by the following:

$$F_N = \xi (4\pi R)^2 \sigma_{12} \sigma_{21}, \quad \sigma_{12} = \rho \frac{M_1}{4\pi R^2}, \quad \sigma_{21} = \rho \frac{M_2}{4\pi R^2} \quad (7)$$

Where accordingly, there is OS polarization from the first mass to a point in the second and a reciprocal polarization from the second to the first.

The hypothesis finds confirmation in the experimental results of deflection of light rays by the Sun [1], the phenomena of gravitational lensing, red displacement in the radiation of massive objects (stars) and in the anomalous acceleration of the "Pioneer" space probe.

The formula for dependence of speed of light on the acceleration of gravity:

$$c_g = c_o \sqrt{1 - \left(\frac{\alpha^{-1}}{r}\right)^2 \frac{g}{4\pi S \sqrt{G\xi}}} \quad (8)$$

At exceeding the OS deformation limit, the environment responsible for gravity and the propagation of electromagnetic waves (light) collapses. Under that condition, both gravity and light propagation disappear. A formal consequence of it may be the reduction of light speed to zero at the border of black holes.

Given the speed of light measured in at the earth surface as **2.99792458 (000000) · 10⁸ m/s**, we may determine by equation (8) its speed in free space as **c_o=2.997924580114694 · 10⁸ m/s**. The difference is slight. From the wave theory of light it is known, that the factor of refraction at transition from the environment with speed **c_o** to another with speed

$$n_{ref} = \frac{c_o}{c} = \frac{\sin(i_o)}{\sin(i_o + i_e)} = \frac{1}{\cos(i_e)}; \quad i_o = 90^\circ$$

c_o is equal . The angle of a descending light

beam normal to the surface of the Sun is equal in this case: $i_o = 90^\circ$.

In seismology, the problem of defining a beam of elastic waves from a source on to a surface and its angle of exit at the opposite surface of the Earth is solved. The angle of exit is analagous to the value of the deviation required value of a deviation of a beam directed towards the sun from a source on a sphere circumscribing the Earth, or at greater distances. In seismology there is a simple formula for defining an exit angle of a seismic wave [2] through

$$p = \frac{R_0}{V(R)} \cos(i_e) = \text{const} [s]$$

the constant parameter of a concrete beam, . Where R_0 – radius of the Earth, $V(R)$ – function of speed of elastic waves depending on the distance (radius from the center of the Earth), i_e – the corner of an exit.

We shall transform the seismological formula for space distances and light speed:

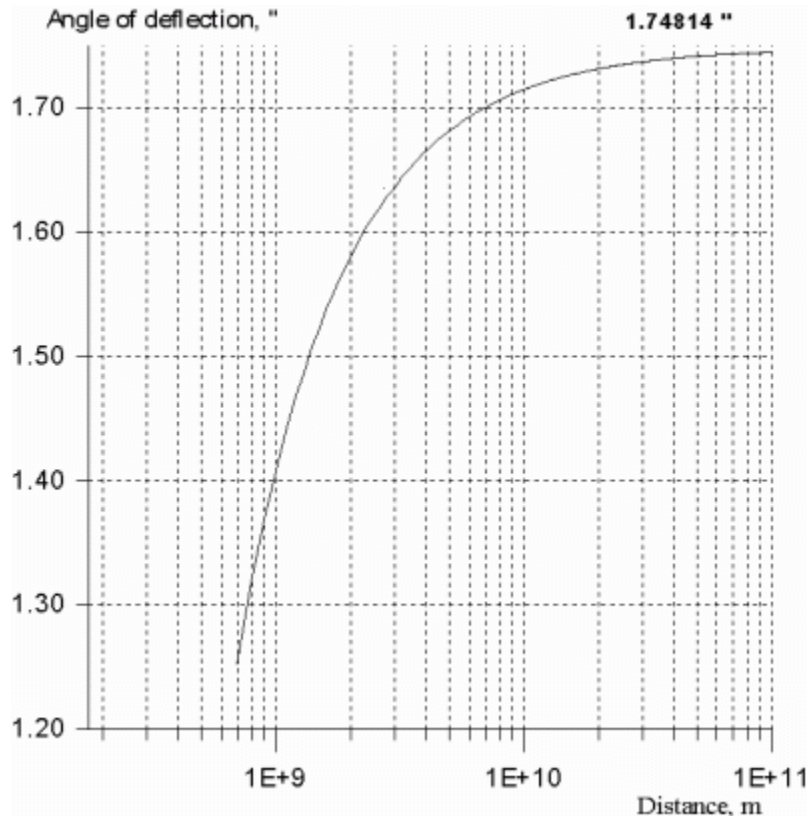
$$i = \arccos\left(\frac{c_e}{R} \sqrt{1 - \frac{\alpha^{-2}}{r_e^2} \frac{g_{sun}}{4\pi S \sqrt{G\xi}}}\right) \cdot \text{const} \cdot 2,062648 \cdot 10^5 \text{ ''} \quad (9)$$

Here R - variable radius of sphere with the sun at center. There is a question about the constant in this formula. The value of a constant must be defined on the basis of global fundamental constants. Otherwise its value would be *ad hoc*. The experimental value of a corner of a deviation [1] is known. On the basis of this size we find, that

$$\text{const} = \Delta t_{const} (g / g_{sun}) / (\pi \cdot \alpha^{-1})^2$$

Here $\pi \cdot \alpha^{-1}$ appear as fundamental parameters of our universe. For example, the Compton wavelength of an electron, $\lambda_C = 4(\pi \alpha^{-1})(r_e + \Delta r_{rb}) = 2,4263058 \cdot 10^{-12} [m]$. The ratio of an acceleration of any mass to the acceleration of the Sun g / g_{sun} enables the binding of a constant to any mass known in nature. $\Delta t_{const} = 1[s]$ – The dimensional factor is that of a constant.

Depending on the distance from source, the angle of deviation of a ray of light at the sun is given in Fig. 1. This is in full conformity with the experimental data.



The difference between seismology and space is that on Earth, the speed of elastic waves increases with depth. Therefore in approaching the sun, the speed of light decreases.

The ability to compare such diverse phenomena as that of earth and space indicates an advantage in the physical approach to OS. The formation in space of so-called "gravitational lenses" also infers a dependence on the speed of light for gravity. If in the earth, beams of elastic waves diverged and focused only in the presence of layers in space, there would be a reduction in speed because of the gravitational influence.

The deflection of a ray of light in accordance with GR gives
$$i = 4 \frac{M_{sun} G}{c^2 R} \cdot 2,062648 \cdot 10^5 = 1.74369''$$
, where R – radius of the Sun. Formula (9) gives: $i_e = 1.7459081''$. **The difference is** $0.00221''$.

Emerging lower speed radiation of electromagnetic waves is accompanied by a speed increase that results in a reduction of frequency according to the formula $\Delta(\lambda \nu) = c_o - c_g$. This is well-known in astrophysics as an observable red displacement in radiation from stars..

NASA [3] provided a detailed analysis of possible causes of the anomalous acceleration of Pioneer space craft. It has investigated 16 possible reasons for this phenomenon, including Special Relativity. The results were

inconclusive. The formula for finding the Doppler frequency displacement in radio communication is
$$\Delta f = f_o \frac{V}{c}$$
. It is sufficient to assume that the speed of light "c" depends on gravitational acceleration. This alone is sufficient to explain the Pioneer anomaly.

Results

1. The hypotheses regarding the nature of gravity does not contradict the well-known facts.
2. The knowledge of the nature of gravity and OS structure offers possible ways of influencing gravity. OS deformation is achieved not only under the influence of gravitational polarization, but also through the influence of electromagnetic waves (photons), electric and magnetic intensities. There is evidence of such influences [4, 5]. Loss of mass (reduction in gravity) and, probably, reduction in inertia was observed. Transformation of potential OS energy into the energy of common substances was made.
3. The concept of the OS environment as a source of gravity can have a decisive influence on our future in the field of power and in three-dimensional motion with reduced gravity and inertia at any speed.

The literature

1. Clifford M. Will. The Confrontation between General Relativity and Experiment // *Preprint of Physical Review*, arXiv: gr-qc/0103036. 2001. Vol. 1.
2. Savarenskij E.F., Kirnos D.P. Element of seismology and seismometry // М.: Гос.тех.-теор. Издат, 1955. 543 pp.
3. Anderson J.D. et al. Study of the anomalous acceleration of Pioneer 10 and 11 // arXiv: gr-qc/0104064, 2002. Vol. 4.
4. Roshchin V.V., Godin S.M. An experimental research of physical effects in dynamic magnetic system // Letters in JTP, 2000, V.26, iss.24, p. 54.
5. Roshchin V.V., Godin S.M. An experimental research of physical effects in dynamic magnetic system // Fundamental problems of natural sciences and engineering, #1, volume 1, SPb, 2000. pp. 202-205.
6. Heaviside O. A. Gravitational and Electromagnetic Analogy // *The Electrician*, 1893. P. 281-282, p. 359.
7. Joseph H.J. Some unpublished notes of Oliver Heaviside // *The Heaviside centenary volume*. London, 1950.