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"THE THEORETICAL PREMISES AND EXPERIMENTAL FACTS OF GRAVITATIONAL SCREENING OF A SUBSTANCE"

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PROGRAM

OF THE 1-ST INTERNATIONAL SCIENTIFIC SEMINAR

"THE THEORETICAL PREMISES AND EXPERIMENTAL FACTS OF GRAVITATIONAL SCREENING OF A SUBSTANCE"

(April 26–27, 2001, RTI TTR, Kharkov, Ukraine)

Thursday, APRIL 26

10.00 — Introductory word of the seminar organizers

10.05 — Terrovere V.R. (Perm State University, Russia). KLEIN'S FOUNDATIONS OF THE UNITED THEORY OF FUNDAMENTAL INTERACTIONS AND PROBLEM OF GRAVITATIONAL SCREENING.

11.00–11.10 — break

11.10 — Zhuck N.A. (Research and Technological Institute of Transcription, Translation and Replication, JSC, Kharkiv, Ukraine). PROPERTIES OF THE YUKAWA POTENTIAL AND GRAVITATIONAL SCREENING OF A SUBSTANCE.

12.00 — Kolosnitsyn N.I. (All-Russian Institute for Metrological Service, Moskow, Russia). CHECKOUT OF THE EQUIVALENCE PRINCIPLE AND GRAVITATIONAL SCREENING.

12.30 — Kolosnitsyn N.I. (All-Russian Institute for Metrological Service, Moskow, Russia). DETECTION OF NEW LONGRANGE FORCES.

13.00-14.00 — lunch break

14.00 — Chernitskii A.A. (St.-Petersburg Electrotechnical University, Russia). DIRECT VARIATION OF SPACE-TIME METRIC BY ELECTROMAGNETIC FIELD.

14.40 — Rodionov B.U. (Moscow Engineering-Physical Institute). "ANTIGRAVITATION" AS A THREADY (LINEAR) DARK MATTER FORM DISPLAY.

15.20–15.30 — break

15.30 — Sannikov-Proskuryakov S.A. (Kharkiv Institute of Physics and Technics, Ukraine), Cabbolet M.J.T.F. (Institute of Fundamental Investigations "Liberalitas", Eindhoven, Holland). THE RENORMALIZED GRAVITATIONAL CONSTANT AND THE EQUIVALENCE PRINCIPLE.

16.10 — Sinitsyn K.N. (Department of Communication, Special Engineering and Automation, Kaluga, Russia). ON THE IDEA OF GRAVITATIONAL SHIELDING OF MATTER IN BINARY MODEL.

16.50 — general discussion

Friday, APRIL 27

09.00 — Krasnoholovets V.V. (Institute of Physics, National Academy of Sciences, Kyïv, Ukraine). ON THE MASS OF ELEMENTARY CARRIERS OF GRAVITATIONAL INTERACTION.

10.00 — Sannikov-Proskuryakov S.A. (Kharkiv Institute of Physics and Technics, Ukraine), Cabbolet M.J.T.F. (Institute of Fundamental Investigations "Liberalitas", Eindhoven, Holland). TOWARDS THE ETHER THEORY (APOLOGY OF ETHER).

10.50–11.00 — break

11.00 — Kolpakov N.D. (Kharkiv State Technical University of Radioelectronics, Ukraine). THE UNITED NATURE OF FUNDAMENTAL INTERACTIONS.

12.00 — Zhuck N.A. (Research and Technological Institute of Transcription, Translation and Replication, JSC, Kharkiv, Ukraine). ON THE UNITED NATURE OF GRAVITATIONAL, ELECTROMAGNETIC AND NUCLEAR INTERACTIONS.

13.00-14.00 — lunch break

14.00 — Balabay V.I. (Research and Technological Institute of Transcription, Translation and Replication, JSC, Kharkiv, Ukraine). DIFFUSION MODEL OF THE PHYSICAL VACUUM AND ITS EXPERIMENTAL CONFIRMATIONS.

14.50 — Tihonov V.Ph. (Kharkiv Institute of Social Progress, Ukraine). POLARIZATION MODEL OF HYDROGEN ATOM.

15.30–15.40 — break

15.40 — Trushenev A.Ya. (HARTRON, Kharkiv, Ukraine). ON OPPORTUNITY OF RADIATION OF A GRAVITATIONAL WAVE IN LOCAL AREA OF SPACE ON THE BASIS OF A VORTEX GRAVITATIONAL FIELD.

16.10 — Sharafiddinov R.S. (Institute of Nuclear Physics, Uzbekistan Academy of Sciences, Tashkent, Ulugbek, Uzbekistan). ON THE GRAVITATIONAL FIELD OF THE ELECTRIC CHARGE (poster).

16.30 — general discussion

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KLEIN'S FOUNDATIONS OF THE UNITED THEORY OF FUNDAMENTAL INTERACTIONS AND PROBLEM OF GRAVITATIONAL SCREENING

V.R. Terrovere[1]

Laboratory of an applied mathematics, Perm State University, 15, Bakireva Str., Perm 614600, Russia

April 26, 2001

After an Einstein the author offers the next speculation based on Erlang's program of F. Klein, proclaiming the thesis: the motion generates geometry. The work is devoted to development new paradigm of the united theory of interactions of fundamental particles and application it to gravitational screening of macroobjects.

"Any problem of physics did not contain so much speculations, how many problem of gravity strength."

Max Laue

1. Introduction

Accepting the point of view of Aristotel that "the nature is afraid of hollow," in a modern physics it is accepted to consider, that the physical vacuum (PV) is a field and substance. The author considers a field only convenient mathematical, but not by physical concept and under PV understands terrain clearance hollow and the fundamental particles. The continuous mediums also are not present. It only mathematical concept. The author used the thesis of F. Klein for the first time in operation [1], which is devoted to the new substantiation of The Special Relativity (SR). Postulating the Euclidean metric, we gain a mechanics of a Newton. Einstein postulates the pseudoeuclidean metric and gains a relativistic mechanics, i.e. he gains a motion from an adopted type of geometry, that is complete contrast to the thesis of F. Klein. The author, as against an Einstein, explored a class of permissible motions in a Euclidean geometry, which are erected by the Shal's theorem, and has found out, that the sliding symmetry on a plane gives in the pseudoeuclidean metric. This type of a motion is termed as a Feynman trajectory, and the relevant particle is termed as the Feynman's particle. A spiral displacementIn gives to the pseudoeuclidean metric in three-dimensional space. Such type of a motion is termed as a trajectory of Kaluza, and the relevant particle is termed as the Kaluza's particle. Apparently, only these two types of a motion generate the pseudoeuclidean metric. Further it is supposed, that all fundamental particles make a spiral displacement. This hypothesis allows to advance the theory of a photon. Set, that it is possible to identify builders uniformly rotaried on the Kaluza's cylinder (or tube of the Feynman) vector of a peripheral velocity of a photon noted in a fixed frame, with vectors of electrical and magnetic intensity of an electromagnetic field, which mathematically represent transversal it is possible to identify electromagnetic waves, and unphysical vector of axial velocity of drift of a photon with the Umov-Pointing's vector of a stream of energy of an electromagnetic field. The interaction of a photon with an electron completely elementally gives in force of the Lorentz, which in this case by nothing differs from force of the Coriolis. By a main merit and reaching in the work [1] the author considers that he managed to clear away "obstruction" in understanding of SR. In the approach of SR author have no any paradoxes [2, p. 60], all their reason in an inaccuracy of its interpretation [3]. The author explains all relativistic and quantum effects by interaction of a fundamental particle with other particles. It is collective appearances, these effects miss for noninteracting particles. It is supposed, that the interval is equal to a Compton wave length of a fundamental particle. It means, that the quantum exposition is possible only within the framework of a final interval. The transition to infinitesimal to an interval kills all quantum effects [4, p. 1219] . Thus, the Klein's approach has appeared fruitful and has given in nontrivial results in comparison with the reference plan of SR, presented as true in

[1] e-mail: yuvn@psu.ru

last instance.

2. The united theory of fundamental interactionsce

2.1. Three presuppositions for making the united theory

Historically problem of physical interactions for the first time has arisen at attempt to explain substance of a gravitation, including a problem on a stability of the Solar system. The Newton has offered the formula for force of a gravitational interaction of two bodies

$$F_N = GMmr^{-2}. \tag{1}$$

The Newton considered this force long-range and in it his error. On a problem Cartesians: whether thinkable the material reason of a gravitation, the Newton has answered, that does not understand remote action without the intermediary and has submitted the solution of this problem to the reader, as he "does not invent hypotheses." By the unique candidate for a role such mediator during a Newton time there could be only solar light. In 1672 Newton has stated an idea about "materiality" of light, and in 1675 has put forward a hypothesis about an origin of light: light is a stream of corpuscles effusing from a light source. But the Newton could not understand, how light, colliding by the Earth, can attract it to the Sun, so he considered that "the particles of bodies or aim to Each other and are tripped, or are crossly repelled and leave from each other." In both cases, according to the third Newton's laws, the Earth should be repelled from the Sun by corpuscles, radiated by it. Newton did not see the third alternative and in it his second error. The Newton force (1) does not take into account relative velocity of interreacting bodies and in it the third error of Newton. In 1785 Ch. Coulomb has offered the formula for force of electrical interaction of two charges similar (1). In 1845 . Gauss has assumed, that the action of one charge is transmitted to another with a finite velocity. Then he wrote to V. Weber: "...I did not manage to find that I considered as a corner stone, namely deduction of additional forces — complementary interaction of superincumbent electrical charges, when both of them are in a motion — from activity, which it is spread not instantaneous, but with fluxion of time, as in case of light" [5, p. 506]. In 1825 Ampere has found force of interaction of two conductors with a current. V. Weber, having taken advantage the Ampere law, has received the formula for force of interaction of two electrical charges propellented on one direct with relative variable velocity, stipulated by their interaction [6, p. 141]

$$F_W = ee(1 - \dot{r}^2 + 2r\ddot{r}). \tag{2}$$

Thus, the problem was solved in case of free slope of charges. The general case has tried to consider by P. Gerber in 1898 [6, p. 168]. The approach of Gerber was erroneous, but he contained very valuable idea about a velocity addition of an interaction mediator and propellented trial bodies (TB). The design synthesis of ingenious guesses of Newton, Gauss and Gerber has allowed the author to offer the united mechanism of fundamental interactions.

2.2. The united mechanism of fundamental interactions

Let there is a globe microradiant with mass m_+ and radius r_+, radiating $Xofa$-particle. The condensate of these particles has mass $M_+(R_+)$. This radiant has rather stable frequency of radiation like atomic clocks. One X-particle is radiated during one period T etc. The apparent density of microradiants is considered as a stationary value. The integrated radiation flow is considered to stationary values also. Such radiant is termed fundamental, a radioactive radiant with a final lifetime otherwise takes place. The electrons, protons concern to fundamental radiants and consequently they are stable. It is supposed, that graviradiant are fundamental also. The instability of such radiant would be characterized by diminution of a gravitational constant in due course and ultimately would give in unbounded removal of planets from the Sun. It is supposed, that the radiant does not rotate. Then X-particle are radiated normally to a surface F of a radiant. The upper limit $\dot{N}_F$ is restricted to a period T and Nerst's diffusion constant D.

The balance of volumetric and surface fluences of X-particles is featured by the equation of Klein-Gordon for $\dot{N}_F$. N.A. Zhuck [7, p. 197] has received this equation for gravitational potential from the General Relativity (GR). Here this equation is obtained on the basis of adopted model of X-radiant. X-field represents radial trajectories of drift of X-particles, and topologically X-radiant is a "sphere-hedgehog." The discreteness in time and space is approximated by smooth functions of the first kind. Then the radiant is the generator of longitudinal spherical waves, and everyone X-particle goes on a circular helix along radius from a stationary value by circular frequency ω, relevant energy $\hbar\omega$, and from a stationary value by velocity of drift c_r. Generally radiant of interaction of two remote from each other bodies are radiated by them X-particles. If these bodies nothing radiate, their direct contact interaction without any intermediary is possible only. If both bodies are emitters, the pattern becomes complicated by contact interaction of X-particles with each other. Therefore we shall consider the most simple case of one radiant. Let's term the second body as a trial body (TB), which plays a role only of X-absorbent. It is supposed, that the relative velocity of a radiant

and absorbent is equal to zero. Let microabsorbent also is a ball with mass m_- and radius r_-. The condensate of these particles has mass $M_-(R_-)$. As this mass can not attract to itself an emitter, it expediently term as a passive inertial mass, and a mass M_+ — as an active gravitational mass. Thus, if there are objects which are not radiating of X-particles, available infringement of a feeble principle of equivalence. The statement especially is erroneous, that both bodies attract each other with identical force. This feature of the formula (1) her founder did not understand also. X-particles can freely transit through an absorbent, but if the part ξ of these particles is immersed, the interaction of X-particles with its absorbents takes place. We give without a deduction a final output for energy of fundamental interaction

$$U_T(0) = g_X M_+ M_- r^{-1} e^{-k(r - {}_X r_+)}, \tag{3}$$

where $k^2 = 3/(DR_+)$. Constant of connection here is entered

$$g_X = \xi \hbar \omega / \left(m_+ m_- / {}_X r_+\right). \tag{4}$$

This constant depends on energy of X-particles and absorption constant. These physical constants determine intensity of various types of fundamental interactions. It is possible, that ${}_X r_+$ there is a constant for all interactions. Then this quantity is the Heisenberg fundamental length. In physics it is intolerable to consider a particle as a point, as it is accepted in a mechanics [8, p. 183]. Only operation with final radius of a fundamental particle eliminates divergences, as well as restriction on a upper limit of Kaluza's frequencies. A helicity and spin of X-particle it are not taken into account in sectional operation, everywhere velocity of a particle is meant as spurious velocity of drift. The constant of connection is constant only for resonant frequencies. X-gravitons, X-quantums and, apparently, X-gluons and Xa-neutrino have this property. Most likely, X-gravitons is of a weak builder of a unknown subnuclear of X-radiation having a discrete spectrum. In macrocosm graviradiation is universal, but it is possible, that in a microcosm there are objects which are not radiating of gravitons. The searches of such objects, if they will crown by success, unclose one more trajectory to control of gravitation

$$U_T(\mathbf{v}) = U_T(0)\left[c_r^2 - 2(\mathbf{c}_r \cdot \mathbf{v}_r) + v^2\right] c_r^{-2}. \tag{5}$$

As at a deduction of this formula was not done of any guesses of a type of interaction, it has universal character.

3. The new theory of a gravitational interaction

3.1. Comparison of the Erlang's program of Klein with the Gilbert-Einstein program

The Klein's thesis has classical roots. Energia of two bodies interaction is determined on a given motion, that only and it is necessary to know, and then and equation of TB motion in a field of an emitter is determined, if, that is very important, the principle of least action is valid

$$\delta S = \delta \int_{t_0}^{t} L(\mathbf{q}, \dot{\mathbf{q}})\, dt = 0. \tag{6}$$

The solution of the Lagrange equations allows to find a trajectory of a particle in a three-dimensional Euclidean space, which will not be natural of geodetic this space. But it is uneasy to pass in a Minkowski space with such metric, in which this trajectory will be geodetic. Enough (6) is to note as

$$\delta S = -mc\,\delta \int_{s_0}^{s} ds. \tag{7}$$

In this space the particle goes on geodetic s with an impulse mc. For example, only trajectories of sliding symmetry and the screw displacements in a three-dimensional Euclidean space are mapped in geodetic Minkowski spaces. It is uneasy to find potentials of an emitter giving in such trajectories. The new theory is under construction under the circumscribed classical plan, but it with use of T-potential (5). X-particle change a TB trajectory, instead of any curvature of space, as space as unphysical object can not have such property. It is uneasy to show, that the Newton potential φ_N generates the metric

$$ds_N^2 = \left[c^2 + 2\varphi_N\sqrt{1-\beta^2} + (\varphi_N/c)^2\right] dt^2 - dr^2, \tag{8}$$

where $\beta = v/c$. This geodetic space is Finsler space $g_{ik}(\mathbf{r}, \dot{\mathbf{r}}, t)$ and only in a nonrelativistic limit transfers in a Riemannian space $g_{ik}(\mathbf{r}, t)$

$$ds_N^2 \simeq \left(c^2 + 2\varphi_N\right) dt^2 - dr^2, \tag{9}$$

It is curious, what even for potential which is not depending on velocity, the geodetic metric depends on velocity of TB. Especially it takes place for T-potential. For example, believing that in (5)

$$\varphi_T \simeq \varphi_N(1+\tau), \tag{10}$$

where $\pi = \beta^2 - 2\beta_r \cos(\mathbf{c}_r, \mathbf{v}_r)$, we shall receive

$$ds_T^2 \simeq \Big[c^2 + 2\varphi_N(1+\tau)\sqrt{1-\beta^2} + \\ + (\varphi_N/c)^2(1+\tau)^2\Big] dt^2 - dr^2. \tag{11}$$

As against to T-space the Einstein space on definition is Riemannian, and consequently, as shown at a deduction of the formula (9) to approximate N-space by E-space it is possible only in a nonrelativistic limit. It means, that GK is powerless to describe a gravitation of relativistic particles on nuclear gauges: all its deductions are error in this area. In opinion of the author in this case scalar T-theory is use more preferable as against tensor's GR. Certainly T-theory is inexact in the sense that it does not take into account a spin of X-particles and TB. But it is uneasy for making, as the account of a spin can find out such effects of a gravitation, which will help to drive it. If in T-theory transition to the geodetic metric is represented to the T-theory completely excessive, in the Gilbert-Einstein approach the transition to this metric is a kern by all GR. Analog of the equations of the Lagrange in it are the equations of geodetic Riemannian space, defined from the Einstein equations. In order that to find a physically sizable trajectory of particles, the inverse transition in a three-dimensional Euclidean space is necessary. Thus, if in T-theory an motion equation of a particle as the final purpose, and anything another also is not required to us, are gained at once from a variation principle of the Lagrange, in GR an affair is more complicatedly: at first it is necessary to decide the equations of an Einstein to find the metric, and then as a corollary the equations of motion as the equations geodetic are gained. Einstein tries to spot gravitation potential of interaction by such by the indirect route. It was not required it to us, as the particular mechanism of a gravitation was adopted which can be improved according to the requirements of experimental datas. GR also supposes betterments. For example, the Einstein categorically who was not desiring to refuse from the Riemannian metric, offered only to use an asymmetrical metric tensor. Physically it meant the indirect account of a spin of X-particles, but not of a spin of TB. The Platini principle pursued the similar purpose [13]. On our sight, the supporters of GR should justify two standings: 1) the geodetic space is only Riemannian in all physical appearances and 2) mapping of a particle trajectory assigned in a three-dimensional Euclidean space, on geodetic Riemannian space, is isomorphic, i.e. it does not suppose any invariance fields. It is a so-called strong principle of equivalence. So in what sense to understand the Klein's thesis: the motion generates geometry? In this case answer states: the trajectory of a particle generates unique four-measurement geodetic space, which to a physical reality there is no relation, including its curvature, which physical sense till now try to search and even to measure this curvature, however as well as notorious "Lorentzian cutting." Key difference of T-theory that in it there are diffusion constants and uptakes having severe physical sense, as with their help it is possible to drive a gravitation. In GR there is nothing similar and in it the author sees its incompleteness. The problem on a radiant of a gravitation is the second essential difference of T-theory from GR. In T-theory it can be only radiant of gravitons. In GR such radiant can be any energy-momentum tensor of a substance: for example, neutrino, gluons, quantums. The series of operations on sectional subjects is published in the journal TMF (editor A.A. Logunov). The oscillation of a gravitation by an electromagnetism agrees GR is physically real, i.e. X-particles are capable to generate gravitons by annihilating. In this sense GR it is wider of T-theory, which does not contain such opportunity.

3.2. Deduction of the equations of T-gravitation and their solution

Only plane motion of TB is considered in coordinates r, φ in T-field (10) with the Lagrangian

$$L_T \simeq A\left(c_r^2 - 2c_r\dot{r}\cos\left(\mathbf{c}\cdot\dot{\mathbf{r}}\right) + \dot{r}^2 + r^2\dot{\varphi}^2\right)c_r^{-2}r^{-1} - \\ -mc\left(c^2 - \dot{r}^2 - r^2\dot{\varphi}^2\right)^{1/2}, \qquad (12)$$

where $A = GMm$. The equations of the Lagrange look like

$$\gamma m r\dot{\varphi}^2 - \gamma m\ddot{r} - (\gamma/c)^2 m\dot{r}(\dot{r}\ddot{r} + \dot{r}\dot{\varphi}^2 + r^2\dot{\varphi}\ddot{\varphi}) - \\ -A(c_r^2 - \dot{r}^2 + 2r\ddot{r} - r^2\dot{\varphi}^2)c_r^{-2}r^{-2} = 0, \qquad (13)$$

$$\gamma m r^2\dot{\varphi} + 2Ar\dot{\varphi}c_r^{-2} = c_T, \qquad (14)$$

where $\gamma = (1-\beta^2)^{-1/2}$.

The obtained system features a trajectory of a particle in T-field. The equation (14) is cubic rather $\dot{\varphi}$. Knowing its solution, it is possible to exclude $\dot{\varphi}$ from the equation (13) and to find $r(t)$. In a nonrelativistic limit of the equation of the Lagrange become simpler

$$mr\dot{\varphi}^2 - m\ddot{r} - A(c_r^2 - \dot{r}^2 + 2r\ddot{r} - r^2\dot{\varphi}^2)c_r^{-2}r^{-2} = 0, \qquad (15)$$

$$mr^2\dot{\varphi} + 2Ar\dot{\varphi}c_r^{-2} = c_T, \qquad (16)$$

At $\dot{\varphi} = 0$ the attractive force, defined agrees (15), precision is equal to Weber force (2). Thus, only version of the Weber corresponds to T-theory from all proposed options of this force [6].

Excluding from (15)

$$\dot{\varphi} = G/(mr^2 + 2Arc_r^{-2}),$$

The basic equation is output

$$r(r+\alpha)\ddot{r} - \frac{\alpha}{2}\dot{r}^2 + f(r) = 0, \qquad (17)$$

where

$$f(r) = \frac{\alpha}{2}c_r^2 - \left(\frac{c_T}{m}\right)^2\left(r + \frac{\alpha}{2}\right)(r+\alpha)^{-2}.$$

For variable ρ, t this equation has the following precise solution in quadratureses

$$t(\rho) = t_0 + \int_{\rho_0}^{\rho} d\rho/\sqrt{u(\rho)}. \tag{18}$$

Herees

$$u(\rho) = u(0)\rho(\rho+1)^{-1} + \lambda\rho(\rho+1)^{-2} - \\ - \left[\lambda + (c_r/\alpha)^2\right](\rho+1)^{-1}, \tag{19}$$

where

$$\alpha = 2Gmc_r^{-2}, \qquad \lambda = \left(\frac{c_T}{m\alpha^2}\right)^2.$$

With the help of the basic equations (13), (14) it does not represent a transactions to decide in frameworks of T-theory all sample problems of GR (problem of Schwarzschild, Kerr etc.) on basis of more prime mathematical kettle. Huge interest represents to test, whether have a place in T-theory all those effects, which predicts by GR, especially in the field of a cosmology (black holes, a mole hole and other exotic). In particular, in a nonrelativistic limit T-potential (10) coincides potential of an Einstein [6, p. 177]

$$\varphi_E = \varphi_N(1 + \beta_\varphi^2). \tag{20}$$

It means, that all effects of GR, predicted with use of this potential, are automatically generated by T-potential. This confirmation it is possible to test. But main not in the solution in these problems, though can find out and key discrepancies in understanding of black holes and a mole holes, and in leaving on a problem of gravitational screening (GS), by which with the help of the instrument of GR practically, and can and in essence, it is impossible to be risen.

4. Problem of gravitation control

Completely to understand a gravitation as a physical appearance signifies to find expedients of its oscillation and, if it is impossible, at least, to find expedients to drive it in compliance with the recommendations of the adequate theory. If we can not realize neither that, nor another, it means, that we at all do not understand, that such gravitation, though we have such theory as GR: we know corollaries of this theory, but we do not know deep essence of the corollaries reason at a level of microprocesses generating gravitation. In the historical review [6] the analysis of the phenomenological theories, predictive gravitational screening: 1782 — G. Lesage, 1906 — H. Lorentz, 1909 — W. Ritz. The list can be prolonged: 1971 — H. Treder, 2000 — N.A. Zhuck. It is those theoretical reserve for today. The affair is behind experiment, and then output on industrial gravienergy, as it has taken place with nuclear and electric power industry.

4.1. Antigravitational experiments: the truth and fictions

The transformation of gravitation energy into the electric power is known. Therefore main forces of the inventors are thrown on transformation of electromagnetic energy in gravitational, as it, seemingly, is different views of energy. O. Heviside [14] had an original sight on a nature electromagnetism as against the Maxwell. Therefore it is represents practical interest to study his scientific inheritance. N. Tesla is the second genius of an electrical technology after the Edison under the right. He aimed to use in the experiments whenever possible major frequencies (up to 160 kHz) and major voltages (up to 100 million Volt). His experimental development represent huge interest also. In a lot of the patents the methods of management of a gravitation are offered. T. Brown worked above effect of an electrogravitation also. In result "the Bifeld-Brown effect" was unclosed [15,16], at which the making of redundant power is accompanied by effect of weight diminution. W. Cooper [17] has offered "the electronic generator ultrahigh-frequency, permitting anpolarize atoms of a body and to liberate them from a ground gravitational attraction." In 1990 F. Sweet demonstrated the invention "the vacuum triode amplifier," which lost a weight of proportionally extracted power. The record antigravitational effect was reached in experiment, at which the diminution of a weight of system in a working mode has made 90%. After death of Sweet in 1995 the widow of the inventor has transmitted his archives to known automobile concern of USA. N.A. Kozyrev observed change of a weight of a rotaried gyroscope. The levitation is found out in the Kharkov Aviation Institute (Ukraine) in experiments on the rotaried cylinders. In the monography "the levitation water" (Germany) and in materials of an one-day closed International Symposium on the water clathrates (December, 1997, Los Angeles, USA) it is informed experiments with the water which has visited in requirements of absence a gravitations. Volume of this worke does not allow to inform full details of the listed above experiments, which are arranged with the author. Under the conferrings of a press [18] famous German scientific dr V.O. Shuma has created electrodynamic machines, which due to prompt gyration soared in air, there characteristics of antigravitational motor of V. Shawberger and converters G. Coler are given. The conferrings of unscientific issuings can be prolonged ad infinitum, but, apparently, in them there is more fantasy, than truth.

4.2. The theoretical substantiations and propositions on gravitational screening

Four methods of gravitational screening (GS) are possible according to theoretical representations: 1) generation of gravitation by an electromagnetic field (GR),

2) use of effect of gravitation weakening for a rotaried body (GR and T-theory), 3) management by interaction of quantums with gravitons and resonant methods of amplification of this interaction (T-theory), 4) management of an absorption constant of TB (T-theory). The experimental examinations of the first and second expedients analyzed above. Besides we shall mark, that by the author designed and the statement of experiment on a levitation of the profile dielectric disk in a high vacuum is offered to embodying. The third method includes three versions of embodying: 1) diversion of gravitons from TB at the expense of radiation by it others X-particles, 2) diversion of gravitons from TB at the expense of radiation by any second radiant of X-particles reducing access of gravitons to TB, 3) an irradiation of a radiant by others X-particles with the purpose to kill an output of gravitons from it. The fourth method includes two versions of embodying: 1) irradiation of TB by others X-particles with the purpose of amplification of its reflection power concerning gravitons, 2) making of a material of TB with a very low absorption constant, i.e. material, which are as much as possible transparent for gravitons. The version of variant of gravitational streams is possible even at the expense of optimization of the TB shape, but, apparently, this passive method is ineffective.

5. Conclusion

The principles are one affair, and the mechanism of an appearance is absolutely other affair. GR is constructed on principles, phenomenological T-theory is constructed on model representations. GR is possible to develop, only changing its principles and finally refusing from initial postulates. T-theory can be developed, improving its basis. T-theory is unclosed in this sense, and GR is the closed theory. GR supposes the vacuum solutions, in T-theory them can not be, as in it a radiant of a gravitation are the gravitons, i.e. yields of decay or synthesis of a substance, instead of curvature of space as in GR. A basis of T-theory is the Mossbauer effect in that view, at which the third Newton's laws is upset. Therefore it is very important to analyse the Noll theorem about requirements of this infringement. T-theory allows directly to take into account a helicity and spin of X-particles and TB. In GR it is impossible.

The author addressed to analyzed above subjects due to acquaintance with Ukrainian physicists in 2000. The situation with a gravitation very much reminds a situation with difficulties of mastering of nuclear energies. In 1941 only two physics I.V. Kurchatov and G.N. Flerov trusted in success of making of a own nuclear bomb. The history is iterated. Now only two physics N.A. Zhuck and L.V. Verozub trust in success of making of "the flying plates." All remaining do not trust, as not trusted in the nuclear program of all remaining domestic physics. That, the time will show, who was right!

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PROPERTIES OF THE YUKAWA POTENTIAL AND GRAVITATIONAL SCREENING OF A SUBSTANCE

N.A. Zhuck[1]

Research and Technological Institute of Transcription, Translation and Replication, JSC
Box 589, 3 Kolomenskaya St., Kharkov 61166, Ukraine

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The unknown characteristics of the Yukawa potential are presented. It is shown that the gravitational interactions are described perfectly by this potential. The analogy between gravitation and nuclear interactions is detected. The appearance of mass defect at merging several material bodies is property both nuclear interactions and gravitation.

1. Introduction

The exposition of gravitational interactions as the Yukawa potential follows from the Einstein's equations with the cosmological term. However our many-sided examinations have shown, that the Einstein's equations with the cosmological term and without it are identical among themselves at the particular content of right members of these equations.

On the other hand, similar potential for exposition of gravitational interactions was offered earlier by Neumann and Seeliger. However making of the General Relativity and series of astronomical discoveries have overshadowed this proposition. And only since 1935 this potential fixedly was included in physics with the Yukawa name, when similar potential was offered for exposition of nuclear forces by Japanese physicist Yukawa (and only after discovery in 1947 of mesons predicted by the theory).

As this potential repeatedly has appeared in a nuclear physics, instead of in a gravitation, can be for this reason its many classical properties have remained unopened and till now remain unknowns for the experts. Among such properties there are also very important properties.

For example, if there is a certain material medium, which each particle of mass m interreacts with other particles according to the Yukawa potential, its binding energy with medium is equal mc^2. And all medium contains the total of such energies.

Other important property of the Yukawa potential is the opportunity of replacement of its by the Newton potential with simultaneous transition from infinite limits of integration to integration in limits of a ball with radius equal to the characteristic radius of the Yukawa potential. This property nothing gives in itself, however it allows to overcome particular mathematical difficulties at the solution of a problems series. For example, at the proof of identity of inertial and gravitational masses.

As our examinations have shown, that as nuclear interactions in the field theory of nuclear forces, and the gravitational interactions are featured in the Yukawa potential, there was a necessity of more detail viewing of properties of this potential.

It especially is important, as both in nuclear physics, and in gravitation there are similar effects: origin of mass defect at merging several material bodyes. We term it with gravitational screening of a substance. Some researchers term it as infringement of the equivalence principle. However what title would not be used, the essence remains one. And on this basis, as we consider, it is possible to explain a series of natural appearances, which till now remain a riddle for the researchers.

And for the beginning we shall make one very important note.

2. Identity of two varieties of the Einstein's equations

As it is known, the Einstein has offered two varieties of the General Relativity equations:

$$R_{ik} - \frac{1}{2}Rg_{ik} = -æT_{ik}, \tag{1}$$

$$R_{ik} - \frac{1}{2}Rg_{ik} - \lambda g_{ik} = -æT_{ik}, \tag{2}$$

where λ is cosmological term; R_{ik} is the Ricci tensor, convolution of the Riman-Cristoffel curvature tensorm R^l_{ijk}; T_{ik} is the energy-momentum tensor of a substance without a substance of a gravitational field;

[1] e-mail: zhuck@insurance.kharkov.ua

g_{ik} is the metric tensor of four-dimension spacetime; R is the curvature scalar, convolution of the Ricci tensor; $æ = 8\pi G/c^4$ is Einstein's constant; G is Newton's gravitational constant; is light speed; $i,\ j,\ k,\ l = 0,\ 1,\ 2,\ 3$.

The polemic about necessity of insert of a cosmological term in the Einstein's equations began since 1917, when the relevant operation was published, and is not terminated till now. However our many-sided examinations have shown, that the difference between the indicated equations is only apparent if correctly to uncover the content of right members of these equations.

The basic property of the left and right parts of the Einstein's equations consists that their divergency is equal to zero, i.e. that they contain conservation laws. And this property is not upset, whether we use the equations (1) or (2).

Unfortunately, this property was considered only as mathematical feature leaking from tensor character of used parameters. However equivalence of the indicated equations can have more severe sense on this property. It is, at first.

And secondly, the energy-momentum tensor of a substance has the features and it is not determined unambiguously even under enough blanket requirements. So if to accept local requirements (dependence on a builder of a field or other functions of state, but not from coordinates; the equality to zero of divergency), it is determined only to within two stationary values [1]. Differently, if the tensor satisfies to above-stated requirements, the tensor

$$T_{ik}^{'} = \alpha T_{ik} + \beta g_{ik}, \tag{3}$$

satisfies to it, where the constant α depends on a choice of system of units, and the constant β depends, besides and from requirements on perpetuity.

Mathematically the replacement in the equations (1) of a tensor T_{ik} on a tensor $T_{ik}^{'}$ is means transition to the equations such as the equations (2). However and the physical substance of such transition interests us. And it is found.

Really, on the assumption of representation that in the world there are no closed systems, the right member of the equations (1) is necessary for presenting as a sum of the energy-momentum tensor T_{ik}^m of an explored material body and the energy-momentum tensor T_{ik}^U of all remaining material bodies of the Universe, which also influence explored process:

$$R_{ik} - \frac{1}{2}Rg_{ik} = -æ\left(T_{ik}^m + T_{ik}^U\right). \tag{4}$$

However taking into account (3), right member of the equations (1) should be submitted as the sum:

$$R_{ik} - \frac{1}{2}Rg_{ik} = -æ\left(\alpha T_{ik} + \beta g_{ik}\right). \tag{5}$$

And now it is necessary to conduct comparison of components in right members of the equations (4) and (5). Obviously, that we in any way did not restrict the energy-momentum tensor T_{ik}^m of a material body, i.e. it is arbitrary quantity. We also to nothing restricted a tensor αT_{ik}, and it also is arbitraryry. However second tensor in (5), i.e. βg_{ik} is not arbitrary, as is determined by a metric tensor g_{ik} and, thus, depends on structure of space-time. Hence, the tensor T_{ik}^m is uniquely compared to the tensor αT_{ik} as equality

$$T_{ik}^m = \alpha T_{ik}, \tag{6}$$

but not with a tensor βg_{ik}.

On the other hand, obviously, that the energy-momentum tensor T_{ik}^U of all material bodies of the Universe can not be compared to an arbitrary tensor αT_{ik} in any way, as it depends on all material sources, i.e. from general structure of space-time of the Universe. Hence, it can be compared only to a tensor βg_{ik}:

$$T_{ik}^U = \beta g_{ik}. \tag{7}$$

Thus, the unique correspondence of components in right members of the equations (4) and (5) is determined. After transposition in (5) βg_{ik} to a left-hand side

$$R_{ik} - \frac{1}{2}Rg_{ik} + æ\beta g_{ik} = -æ\alpha T_{ik} \tag{8}$$

and with the account (6) we have

$$R_{ik} - \frac{1}{2}Rg_{ik} + æ\beta g_{ik} = -æT_{ik}^m. \tag{9}$$

The obtained expression (9) is similar to the equations (2), and after substitution of equality

$$\beta = -\frac{1}{4}T, \tag{10}$$

where T is a scalar of an substance energy-impulse of the flat Universe, we gain the equations

$$R_{ik} - \frac{1}{2}Rg_{ik} - \lambda g_{ik} = -æT_{ik}^m, \tag{11}$$

which are identical to the equations (2). However as against last equation (11) reflect the physical side of the left-hand and right parts more precisely.

Really, now the tensor of material object is in a right member, which convolution in case of a solid body is equal

$$T^m = \rho_m c^2, \tag{12}$$

where ρ_m is a density of this body.

The left-hand part of the equations (11) contains a cosmological constant λ, which is proportional to

convolution of an energy-momentum tensor of the Universe. For pulverized state of a Universe substance the convolution is equal

$$T = \rho_0 c^2. \tag{13}$$

Thus, the equations (1) and (2) differ from each other not only presence of an addend from a cosmological constant λ, but also content of right members. Namely: the right member of the equation (1) contains the cumulative energy-momentum tensor of a sectional material body and all remaining bodies of the Universe. We shall designate this tensor T_{ik}^{Σ}, that further to not be confused in labels:

$$R_{ik} - \frac{1}{2} R g_{ik} = -æ T_{ik}^{\Sigma}. \tag{14}$$

Only now becomes obvious, that the equations (14) and (11) (and together with them and their prototypes (1) and (2)) are identical each other. Between that, by the form of equations (1) and (2) it will not tell, as the right members at them were designated equally, that, naturally, guessed a uniformity and contents of these parts.

3. Transformation of the universal gravitation law

The Eqs. (11) gives the exterior solution as the Yukawa potential for the stable spherical-symmetric material body with mass m [2]

$$\varphi = -\frac{Gm}{r} \mathrm{e}^{-\frac{r}{R_0}}, \tag{15}$$

in which the quantity R_0 is termed as the gravitational interactions radius, is determined under the formula

$$R_0 = c\sqrt{\frac{3}{4\pi G \rho_0}}. \tag{16}$$

also depends on medial density of the Universe ρ_0 [2].

For two material objects with m_1 and m_2 masses the following gravitation law is received

$$F = G\frac{m_1 m_2}{r^2} \mathrm{e}^{-\frac{r}{R_0}} \left(1 - \frac{r}{R_0}\right). \tag{17}$$

If the exponent from the gravitation law (17), which is true for the real Universe, is expanded in a series, without going beyond the first order, linear approximation will be obtained, i.e.,

$$F \approx G\frac{m_1 m_2}{r^2} \left(1 - \frac{r^2}{R_0^2}\right). \tag{18}$$

An analysis of the expression demonstrates that in the linear approximation, all material points of the Universe interact only within the radius of gravitational interaction R_0 and that the law of interaction differs from the Newtonian law.

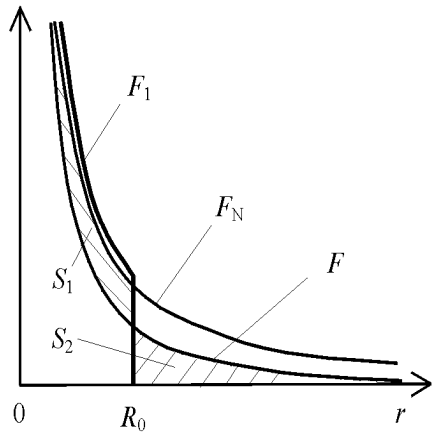

Figure 1: Comparison of gravitation laws

Let us analyze a situation which is artificially created, using diagrams of precise dependences of the forces on the distance under the formulas of Newton and the actual gravitation law

$$F_N = G\frac{m_1 m_2}{r^2}, \tag{19}$$

$$F = G\frac{m_1 m_2}{r^2} \mathrm{e}^{-\frac{r}{R_0}} \left(1 + \frac{r}{R_0}\right), \tag{20}$$

which are shown in Fig. 1.

We can determine the area S_1 closed between the curves in an interval from 0 to R_0

$$S_1 = \int_0^{R_0} F' dr = \int_0^{R_0} (F_N - F) dr =$$

$$= G m_1 m_2 \int_0^{R_0} \left[\frac{1}{r^2} - \frac{1}{r^2} \mathrm{e}^{-\frac{r}{R_0}} \left(1 + \frac{r}{R_0}\right)\right] dr =$$

$$= G\frac{m_1 m_2}{r} \left(1 - \mathrm{e}^{-\frac{r}{R_0}}\right) \Big|_0^{R_0} =$$

$$= G\frac{m_1 m_2}{R_0} \left(1 - \mathrm{e}^{-1} - 1\right) = -G\frac{m_1 m_2}{R_0} \mathrm{e}^{-1}. \tag{21}$$

In a chain of transformations (21), the limit

$$\lim_{r \to 0} \left(\frac{1}{r} - \frac{\mathrm{e}^{-\frac{r}{R_0}}}{r}\right) =$$

$$= \lim_{r \to 0} \frac{1}{r} \left(1 - 1 + \frac{r}{R_0} - \frac{r^2}{2R_0^2} + \frac{r^3}{6R_0^3} - \ldots\right) =$$

$$= \lim_{r \to 0} \left(\frac{1}{R_0} - \frac{r}{2R_0^2} + \frac{r^2}{6R_0^3} - \ldots\right) = \frac{1}{R_0}. \tag{22}$$

is utilized.

Now let us determine the area S_2 that is enclosed between the curve of the actual gravitation law and the abscissa axis in an interval from R_0 to $+\infty$:

$$S_2 = \int\limits_{R_0}^{\infty} F\,dr = \int\limits_{R_0}^{\infty} G\frac{m_1 m_2}{r^2}\,\mathrm{e}^{-\frac{r}{R_0}}\left(1+\frac{r}{R_0}\right)dr =$$

$$= G\frac{m_1 m_2}{r}\,\mathrm{e}^{-\frac{r}{R_0}}\Big|_{R_0}^{\infty} = -G\frac{m_1 m_2}{R_0}\,\mathrm{e}^{-1}. \qquad (23)$$

As is evident from results (21) and (22), the areas S_1 and S_2 are equal. Therefore, from the "energy point" of view, the gravitation law (20), which is true for the real Universe, can be replaced with the Newton gravitation law, having confined the radius of action of the gravitational force by value R_0 in agreement with the function [2]

$$F_1 = \begin{cases} G\dfrac{m_1 m_2}{r^2} & \text{if } r \le R_0, \\ 0 & \text{if } r > R_0. \end{cases} \qquad (24)$$

The approach presented makes it possible to solve a series of remarkable problems and we will demonstrate this in the next sections.

4. Mass as the bond measure with the Universe

Let us determine the bond energy of a material point with a mass m with the Universe. Mathematically this corresponds to the calculation of the work to remove all masses of the Universe to the infinity from an isolated point [2].

To carry out the above procedure, let us allocate a spherically symmetric layer of space around the point m as is depicted in Fig. 2.

As usually, we believe that the Universe is homogenous and isotropic and its geometry is Euclidean. We also assume that the greater the scales considered, the more condensed, i.e. more static the Universe becomes. On the most global scale, it is static at all. Therefore, there is a global isolated frame of reference.

For the sake of simplicity let us "press" all the masses of the isolated layer into one mass and put it in one place, for example, at a point a. Then this mass will attract point m with the force

$$F_S = G\frac{mM_S}{r^2}\,\mathrm{e}^{-\frac{r}{R_0}}\left(1+\frac{r}{R_0}\right) =$$

$$= G\frac{m4\pi r^2 dr\rho_0}{r^2}\,\mathrm{e}^{-\frac{r}{R_0}}\left(1+\frac{r}{R_0}\right) =$$

$$= 4\pi G\rho_0 m\,\mathrm{e}^{-\frac{r}{R_0}}\left(1+\frac{r}{R_0}\right)dr. \qquad (25)$$

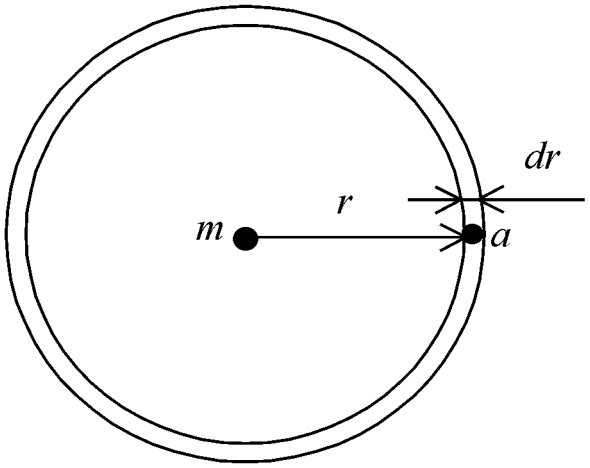

Figure 2: On the definition of bond energy of a massive point with the Universe

To remove the masses of the said layer to the infinity, it is necessary to do the following work (for convenience we use the variable dr_1)

$$A_S = 4\pi G\rho_0 m\int\limits_{r}^{\infty}\mathrm{e}^{-\frac{r_1}{R_0}}\left(1+\frac{r_1}{R_0}\right)dr_1 =$$

$$= 4\pi G\rho_0 m\left(\int\limits_{r}^{\infty}\mathrm{e}^{-\frac{r_1}{R_0}}dr_1 + \frac{1}{R_0}\int\limits_{r}^{\infty} r_1\,\mathrm{e}^{-\frac{r_1}{R_0}}dr_1\right) =$$

$$= 4\pi G\rho_0 m\left(-R_0\,\mathrm{e}^{-\frac{r_1}{R_0}} + R_0\,\mathrm{e}^{-\frac{r_1}{R_0}} - r_1\,\mathrm{e}^{-\frac{r_1}{R_0}}\right)\Big|_{r}^{\infty} =$$

$$= 4\pi G\rho_0 m r\,\mathrm{e}^{-\frac{r}{R_0}}. \qquad (26)$$

The bond energy of the point m with the Universe will be equal to the total work of removing all the masses of the spatial layer to the infinity

$$E_0 = \frac{1}{3}\int\limits_{0}^{\infty} A\,dr = \frac{4\pi G\rho_0 m}{3}\int\limits_{0}^{\infty} r\,\mathrm{e}^{-\frac{r}{R_0}}dr =$$

$$= \frac{4\pi G\rho_0 m}{3}\left[\mathrm{e}^{-\frac{r}{R_0}}\left(R_0^2 - rR_0\right)\right]_{0}^{\infty} =$$

$$= \frac{4\pi G\rho_0 m}{3}\left(-R_0^2\right) = \left|R_0 = \sqrt{\frac{3c^2}{4\pi G\rho_0}}\right| = -mc^2. \qquad (27)$$

Thus the bond energy of the mass point m with all other masses of the Universe has turned out to be determined by the formula

$$E_0 = -mc^2, \qquad (28)$$

which is exactly is equal to the intrinsic energy of the same point taken with the opposite sign.

In other words, the mass of any object appears as the measure of its connection with the Universe.

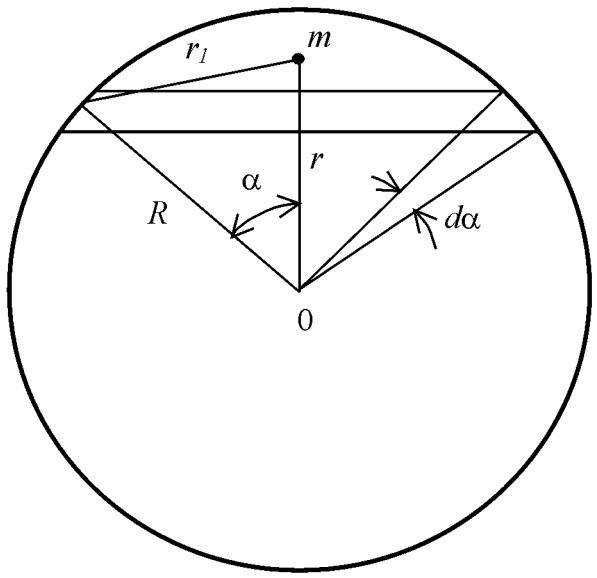

Figure 3: On the deriving of the law of interaction with a ball leayr for the actual gravitation law

5. Actual interplay with spherically symmetric material shell

In classical physics and, as it is believed even in GR, there is a special theorem which proves that the gravitational field is lacking inside a spherically symmetric material shell or, to be more precise that the resultant of all the forces of gravity is equal to zero. Let us consider how the situation will change with the use of the actual gravitation law.

Let mass point m be located at an arbitrary place of the inner cavity of a spherically symmetric material shell that has a radius R, an area density ρ_s and a thickness that is negligibly small in comparison to other sizes the shell (Fig. 3).

We can select a narrow ring from this shell. Let the ring have the angular and linear width $d\alpha$ and $Rd\alpha$ respectively so that the line r between the center of the ball 0 and the said point presents the axis of symmetry for the ring. The radius of the ring is equal to $R\sin\alpha$, the circuit is equal to $2\pi R\sin\alpha$, and the distance between it and the point m equals to r_1. Then the ring's mass is

$$M_R = (2\pi R\sin\alpha)\,(Rd\alpha)\,\rho_s = 2\pi R^2\rho_s\sin\alpha d\alpha. \quad (29)$$

On the other hand, the potential energy U_R of the mass point m in the gravitational field of the ring is determined by the dependence

$$U_R = -G\frac{mM}{r_1}\,\mathrm{e}^{-\frac{r_1}{R_0}} =$$

$$= -G\frac{m2\pi R^2\rho_s\sin\alpha d\alpha}{r_1}\,\mathrm{e}^{-\frac{r_1}{R_0}}. \quad (30)$$

By the cosine theorem, one gets

$$r_1^2 = r^2 + R^2 - 2rR\cos\alpha. \quad (31)$$

After term-by-term derivation of expression (31) we have

$$2r_1dr_1 = 2rR\sin\alpha d\alpha. \quad (32)$$

With the help of (32), expression (30) can be transformed to

$$U_R = -G\frac{m2\pi R\rho_s dr}{r}\,\mathrm{e}^{-\frac{r_1}{R_0}}. \quad (33)$$

The total potential energy U_S of the point with the mass m in the gravitational field of the entire ball layer is found as the integral

$$U_S = \int\limits_{R-r}^{R+r} Udr_1 = \int\limits_{R-r}^{R+r}\left(-G\frac{m2\pi R\rho_s}{r}\,\mathrm{e}^{-\frac{r_1}{R_0}}\right)dr_1 =$$

$$= -G\frac{m2\pi R\rho_s}{r}\int\limits_{R-r}^{R+r}\mathrm{e}^{-\frac{r_1}{R_0}}dr_1 =$$

$$= -G\frac{m2\pi R\rho_s}{r}\,(-R_0)\,\mathrm{e}^{-\frac{r_1}{R_0}}\Big|_{R-r}^{R+r} =$$

$$= G\frac{m2\pi R\rho_s R_0}{r}\left(\mathrm{e}^{-\frac{R+r}{R_0}} - \mathrm{e}^{-\frac{R-r}{R_0}}\right). \quad (34)$$

To make further transformations either, expression (34) can be presented in the form

$$U_S = k\frac{\mathrm{e}^{-\frac{R+r}{R_0}}}{r} - k\frac{\mathrm{e}^{-\frac{R-r}{R_0}}}{r}, \quad (35)$$

where the designation

$$k = Gm2\pi R\rho_s R_0. \quad (36)$$

is introduced.

The force acting on the mass particle on the part of the layer, is defined by the dependence

$$F_S = -\frac{\partial U_S}{\partial r} =$$

$$= -k\frac{\left(-\frac{1}{R_0}\right)\mathrm{e}^{-\frac{R+r}{R_0}}r - \mathrm{e}^{-\frac{R+r}{R_0}}}{r^2} +$$

$$+k\frac{\frac{1}{R_0}\mathrm{e}^{-\frac{R-r}{R_0}}r - \mathrm{e}^{-\frac{R-r}{R_0}}}{r^2} =$$

$$= k\frac{\mathrm{e}^{-\frac{R+r}{R_0}}}{r^2}\left(1+\frac{r}{R_0}\right) - k\frac{\mathrm{e}^{-\frac{R-r}{R_0}}}{r^2}\left(1-\frac{r}{R_0}\right). \quad (37)$$

Substituting (36) into (37), we have

$$F_S = \frac{Gm2\pi R\rho_s R_0}{r^2}\times$$
$$\times\left[\mathrm{e}^{-\frac{R+r}{R_0}}\left(1+\frac{r}{R_0}\right) - \mathrm{e}^{-\frac{R-r}{R_0}}\left(1-\frac{r}{R_0}\right)\right]. \quad (38)$$

If we take into account that $4\pi R^2\rho_s$ represents the mass M_S of the layer, we immediately obtain the final formula for the force of interaction between the material point with the mass m that is found inside the layer and the layer

$$F_S = \frac{GmM_S}{r^2}\frac{R_0}{2R}\times$$
$$\times\left[\mathrm{e}^{-\frac{R+r}{R_0}}\left(1+\frac{r}{R_0}\right) - \mathrm{e}^{-\frac{R-r}{R_0}}\left(1-\frac{r}{R_0}\right)\right]. \quad (39)$$

The analysis of formula (39) shows that the closer the point is to the shell (i.e. the closer r to R within the interval $[0,\ R]$), the more strongly it is attracted to the shell. Equivalently, any compression of material substance of the Universe as a shell leads to the further development of such a shell. That is why the Universe at a large scale has a cellular pattern (as a soap foam), in which accumulations of galaxies are located in thin walls of those cells and super accumulations are located at the intersections of the cells.

6. Dependence of a body mass on its size

Under the actual gravitation law, the availability of shielding properties in a substance supposes that the mass of a material body depends on the size of the body, while its density remains unchanged.

To determine the dependence of the mass of the material body on its size, we may treat a homogeneous sphere of a radius R with density ρ. Apparently, the mass is exhibited only through interaction. Therefore we shall determine the force with which the sphere attracts a trial material particle with a mass m located on the surface of the sphere using the formula (38) derived. In doing so, we need to take into account the fact that if the thickness of the material shell is equal to dr, then surface density equal [2]

$$\rho_s = \rho dr. \quad (40)$$

Hence the force with which the whole of the sphere attracts the particle will be equal to an integral in which the factor 1/3 includes the "effect of pyramid" in the definition of appropriate volumes

$$F = \frac{1}{3}\int_R^0 F_S\,dr = \frac{Gm2\pi R\rho_s R_0}{3}\times$$
$$\int_R^0 \frac{1}{r^2}\left[\mathrm{e}^{-\frac{R+r}{R_0}}\left(1+\frac{r}{R_0}\right) - \mathrm{e}^{-\frac{R-r}{R_0}}\left(1-\frac{r}{R_0}\right)\right]dr =$$
$$= \frac{k}{3}\left[\frac{\mathrm{e}^{-\frac{R+r}{R_0}}}{r}\Big|_R^0 - \frac{\mathrm{e}^{-\frac{R-r}{R_0}}}{r}\Big|_R^0\right] =$$
$$= \frac{k}{3}\left[\lim_{r\to 0}\frac{\mathrm{e}^{-\frac{R+r}{R_0}}}{r} - \frac{\mathrm{e}^{-\frac{2R}{R_0}}}{R} - \lim_{r\to 0}\frac{\mathrm{e}^{-\frac{R-r}{R_0}}}{r} + \frac{1}{R}\right] =$$
$$= \frac{k}{3}\left[\frac{1}{R} - \frac{\mathrm{e}^{-\frac{2R}{R_0}}}{R}\right] = \frac{k}{3}\left(1-\mathrm{e}^{-\frac{2R}{R_0}}\right)\cdot\frac{2c^2}{2c^2} =$$
$$= \frac{mc^2}{2R_0}\left(1-\mathrm{e}^{-\frac{2R}{R_0}}\right). \quad (41)$$

In the chain of transformations (41), there are two integrals with the indeterminate result of the form $1/\infty$; however, the integrals are cancelled since they have the same limits at $r\to 0$ and opposite signs.

According to the classic Newton formula, the force of attracting of a particle by the sphere with radius R and density ρ whose mass we designate as M_N, is equal to

$$F_N = G\frac{mM_N}{R^2}. \quad (42)$$

From expression (42), the mass of the sphere can be expressed as

$$M_N = \frac{R^2}{mG}F_N. \quad (43)$$

Let us now write the manifested mass M of the sphere on the left-hand side of expression (43) and replace the Newton force of attraction F with force of attraction from (41) on the right-hand side of expression (43). We then obtain

$$M = \frac{R^2}{mG}\cdot\frac{mc^2}{2R_0}\left(1-\mathrm{e}^{-\frac{2R}{R_0}}\right). \quad (44)$$

The trial mass is canceled and we finally get

$$M = \frac{R^2c^2}{2GR_0}\left(1-\mathrm{e}^{-\frac{2R}{R_0}}\right). \quad (45)$$

In the classic expression, the mass of a sphere-shaped material body can also be determined as follows

$$M_N = \frac{4\pi R^3}{3}\rho = \frac{4\pi R^3}{3}\rho\cdot\frac{Gc^2}{Gc^2} = \frac{R^3c^2}{R_0^2G}. \quad (46)$$

Let us consider what is the first approximation for the mass (45) in the case $R << R_0$. If the exponent is expanded into a series and only one term after the unit is kept, we obtain

$$M = \frac{R^2c^2}{2GR_0}\left[1-\left(1-\frac{2R}{R_0}\right)\right] = \frac{R^3c^2}{GR_0^2}, \quad (47)$$

which exactly corresponds to the expression for the mass that follows from classic equality (46).

If we analyze expression (45) in the same way when $R >> R_0$, or, equivalently, when $R \to +\infty$ we will gain

$$M = \lim_{R\to+\infty} \frac{R^2c^2}{2GR_0}\left(1 - \mathrm{e}^{-\frac{2R}{R_0}}\right) = \frac{R^2c^2}{2GR_0}. \qquad (48)$$

The result obtained may be logically explained since it demonstrates that, if the material body is large or the radius of the gravitational interaction is small, the external layers of the body will virtually completely shield the internal layers. Therefore the manifested mass of the body will be defined purely by the area of the external surface.

Accordingly, with $R << R_0$ the mass of the spherical material body is defined by the dependence

$$m = m\left(R^3\right), \qquad (49)$$

while with $R >> R_0$, the mass behaves in the following manner

$$m = m\left(R^2\right), \qquad (50)$$

These two presentations have quite clear logical arguments. In the first case, (49), the mass of the body does not differ from the classical case, but in the second case, (50), the mass is substantially smaller. The greater the proportion R/R_0, the greater the discrepancy.

These properties of the actual gravitation law bring about another outcome: if two identical objects are united to form one object, without changing the density, then the manifested mass of the integrated object will be smaller than the masses of the two initial components. Here, the defect of masses appears

$$\Delta m = m + m - M > 0, \qquad (51)$$

It is caused by the shielding properties of the upper layers of material bodies in relation to their deep-laid layers.

To determine the magnitude of the defect of masses, let us designate the radius and the mass of one of the initial bodies as R_1 and m_1 respectively and then, based on relation (45), express the mass as

$$m_1 = m_N \frac{R_0}{2R_1}\left(1 - \mathrm{e}^{-\frac{2R_1}{R_0}}\right). \qquad (52)$$

Now, from the condition of doubling the volume of the total body,

$$R_2 = \sqrt[3]{2}R_1 \qquad (53)$$

we find its manifested mass

$$M_2 = m_N \frac{R_0}{2\sqrt[3]{2}R_1}\left(1 - \mathrm{e}^{-\frac{2\sqrt[3]{2}R_1}{R_0}}\right). \qquad (54)$$

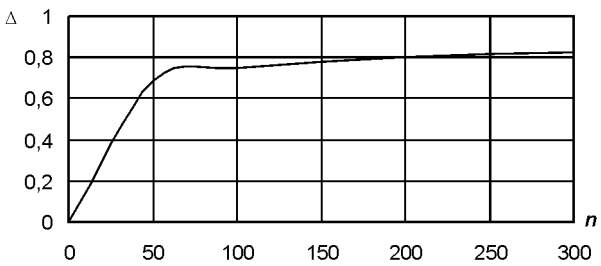

Figure 4: Dependence of the relative defect of masses on the number of material bodies being merged

Then the defect of masses resulting from the fusion of the two material bodies will constitute

$$\Delta m_2 = 2m_1 - M_2 =$$
$$= 2m_N \frac{R_0}{2R_1}\left[1 - \mathrm{e}^{-\frac{2R_1}{R_0}} - \frac{1}{\sqrt[3]{2}}\left(1 - \mathrm{e}^{-\frac{2\sqrt[3]{2}R_1}{R_0}}\right)\right]. \qquad (55)$$

The defect of masses for an arbitrary number n of bodies being merged will be equal to

$$\Delta m_n = 2m_N \frac{R_0}{2R_1} \times$$
$$\times \left[1 - \mathrm{e}^{-\frac{2R_1}{R_0}} - \frac{1}{\sqrt[3]{n}}\left(1 - \mathrm{e}^{-\frac{2\sqrt[3]{n}R_1}{R_0}}\right)\right]. \qquad (56)$$

Inasmuch as the value m_N is unobservable, it is more suitable to express the defect of masses through the observed value m_1

$$\Delta m_n = nm_1\left[1 - \frac{1 - \mathrm{e}^{-\frac{2\sqrt[3]{n}R_1}{R_0}}}{\sqrt[3]{n}\left(1 - \mathrm{e}^{-\frac{2R_1}{R_0}}\right)}\right]. \qquad (57)$$

In a particular case when $R_1 = R_0$ we have

$$\Delta m_n = nm_1\left[1 - \frac{1 - \mathrm{e}^{-2\sqrt[3]{n}}}{\sqrt[3]{n}\left(1 - \mathrm{e}^{-2}\right)}\right]. \qquad (58)$$

On the other hand, the defect of masses for one material body being merged equals

$$\Delta m_n^1 = m_1\left[1 - \frac{1 - \mathrm{e}^{-2\sqrt[3]{n}}}{\sqrt[3]{n}\left(1 - \mathrm{e}^{-2}\right)}\right]. \qquad (59)$$

Let us analyze the behavior of the value of the relative defect of masses [2] that can be obtained from expression (59)

$$\Delta = 1 - \frac{1 - \mathrm{e}^{-2\sqrt[3]{n}}}{\sqrt[3]{n}\left(1 - \mathrm{e}^{-2}\right)}, \qquad (60)$$

For this purpose, we may plot a chart (see Fig. 4).

The analysis of the dependences obtained demonstrates that the gravitational force, as well as nuclear forces, are saturated, that is, there is some analogy between the interactions. Nonetheless, the direct identity between these two interactions cannot be established on the basis of the revealed property of the gravitational force, as in the microcosm, not only the nuclear interactions (or the gravitational one, if these two are identical), but also the electromagnetic interaction should be taken into account.

Besides we do not know the precise inner structure of fundamental particles. Therefore further studies can be conducted in the given direction only if a series of assumptions has been made. However, such studies are beyond the scope of the given book and, consequently, herein we do not perform detailed analytical and numerical calculations. We would only like to point out that the experimentally determined relative defect of masses varies from 0.8 to 1.0 %. On the other hand, it follows from Fig. 4 that at $N > 50$ the relative defect of masses equals from 70 to 80 %, but this takes place only on the condition $R_1 = R_0$. The exact magnitudes (corresponding to the experiment) are obtained only at $R_1/R_0 \approx 0.003$ at $N = 50$ and this evidently points to the composite structure of protons and neutrons. By and large the proportion has appeared nonconstant, varying from 0.03 for light elements up to 0.001 for heavy ones.

In cosmology, the revealed property of the appearance of defect of masses is to be exhibited when substance is crowded in galaxies. It is this property that can explain by the virial paradox.

On the other hand, if not the fusion of material bodies but the contraction of one object occurs (for example, owing to gravity), it will be interesting to trace how its mass and size change with the radius of gravitational interaction. In other words, this analysis should answer the question about whether the collapse of substance, which results in the appearance of a black hole, is possible.

To clarify this problem, let us express the density of a material body from expression (46) and substitute it in the expression for the radius of gravitational interaction. As the result we get [2]

$$R_0 = \sqrt{\frac{3c^2}{4\pi G\rho}} = \left|\rho = M_N \frac{3}{4\pi R^3}\right| = \\ = \sqrt{\frac{c^2}{GM_N}} \cdot R^{\frac{3}{2}}. \tag{61}$$

In the expression obtained, the radius of gravitational interaction R_0 is to the first power and the radius of the body R is to the power of 3/2. This means that the first magnitude varies much faster than the second. Therefore, when the body contracts, the gravitational closing of its internal parts takes place much more rapidly than the body's size is reduced. This in its turn suggests that no black holes or furthermore no collapse of a material body into a point with infinite density happens.

7. Conclusion

As it is visible from the above-stated examination of properties of the gravitation law based on the Yukawa potential, the actual natural appearances quite can be featured to the data by the law. Moreover, many properties of the Universe (large-scale cellular structure, virial paradox etc.) have received a logic explanation only within of the law framework. Besides the law has appeared identical not only for gravitation, but also for nuclear interactions, identical fashion explaining occurrence of mass defect, binding energy of parts whole and aggregate internal energy of material objects. Therefore we have termed the law as the actual law of gravitation as against the Newton's gravitation law, which has restricted frameworks of application.

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DIRECT VARIATION OF SPACE-TIME METRIC BY ELECTROMAGNETIC FIELD

A.A. Chernitskii[1]

St.-Petersburg Electrotechnical University, Prof. Popov str. 5, 197376 Russia

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In view of the problem for compensation or shielding of the gravitational interaction the unified approach based on nonlinear electrodynamics is considered. In this approach two long range interactions of the material objects, electromagnetism and gravitation, are presented as nonlinear electrodynamics effects of the first and second orders accordingly by the small field of distant particles-solitons. In the second order there is an effective Riemann space induced by electromagnetic filed, i.e. we have the direct variation of space-time metric by electromagnetic filed. This effect is real, irrespective of the interpretation for gravitational interaction. The possibility for the compensation of gravitation by electromagnetic field is shown with help of a simplest example in the context of this approach.

One of major problems of the modern physics is the problem for overcoming of the gravitational attraction without the use of aerodynamic effects. In other words the question is raised as to whether it is possible to find a new physical effect for a compensation or even a shielding of the gravitational interaction?

On the other hand the conventional Einstein's gravitational theory encounters with difficulties for description of some effects. First of all this is the so-called problem of dark matter. Here we shall not discuss this problem but the existence of it is the possible notification for construction of a more general theory including the present gravitational theory (in its reality adequate part) as the special case. This more general theory must naturally unified the gravitation and the electromagnetism.

In this connection it is necessary to refer separately to the known Podkletnov's experiment [1]. Now we have intense discussion for the pros and cons of these results. But in any case just such experiments must manifest the unified character of the electromagnetism and the gravitation, because they become closely entangled in these experiments.

Such general unified approach is developed by the author in his theoretical works [2] – [7]. In this approach the gravitation is a second order effect of interaction between the electromagnetic particles-solitons. It is proposed to consider a nonlinear electrodynamics field model with space point singularities [6] as the unified field model.

Thus the main idea is that everything in material world is described by the unified field model, namely nonlinear electrodynamics. The electromagnetic solitons play the role of the particles. The problem for long-range interaction of such solitons can be considered by perturbation method with respect to the small filed of distant solitons. In this case the first order gives the Lorentz force for the soliton under consideration, i.e. the electromagnetic interaction. The second order gives the effect of induced Riemann space, that is the soliton moves on geodesic line of some effective Riemann space with metric depending on squares of the electromagnetic field components for distant solitons. This is the gravitational interaction. The higher orders may give new interesting effects.

In general, the effect of inducing Riemann geometry is the real effect for nonlinear electrodynamics, irrespective of the interpretation for gravitational interaction. But this effect gives variation for the metric of space-time in which electromagnetic particles are moved and light is propagated. At present, overwhelming the majority of physicists agree that the gravitation is described by the metric tensor for Riemann space. This space may be real as in Einstein's gravitational theory or effective as in bimetric theories for gravitation. Therefore the nonlinear electromagnetic field can modify directly the gravitation.

At the present time all physicists also agree (from various point of view) that the vacuum electrodynamics is nonlinear. The problem consists only in a concrete form of model nonlinearity. The future experiments must give an answer for this question (see for example [8]). But now the nonlinear electrodynamical model which was considered by M. Born and L. Infeld [9] has attracted considerable interest, because it appear also in the superstring theory [10]. The Born-Infeld electrodynamics is derived from a variational principle proposed by A.S. Eddington [11]. It also has in view some unified approach. This principle has the following

[1] e-mail: aa@cher.etu.spb.ru

very geometrical form:

$$\delta \int \sqrt{|\det(g_{\mu\nu} + \chi F_{\mu\nu})|}\,(\mathrm{d}x)^4 = 0, \tag{1}$$

where the Greek indices take values $0, 1, 2, 3$, $g_{\mu\nu}$ are components of metric for space-time, $F_{\mu\nu}$ are components of the tensor of electromagnetic field, χ is a dimensional constant.

For the flat space-time metric $g_{\mu\nu}$ this variational principle can be the base for the unified field theory that we propose to consider.

The Born-Infeld system of equations [9] is obtained from principle (1). This system of equation has the following very notable form of the characteristic equation [7]:

$$\mathfrak{g}^{\mu\nu} \frac{\partial \Phi}{\partial x^\mu} \frac{\partial \Phi}{\partial x^\nu} = 0, \tag{2}$$

$$\mathfrak{g}^{\mu\nu} \equiv g^{\mu\nu} - \chi^2 T^{\mu\nu}, \tag{3}$$

where $T^{\mu\nu}$ are components of symmetrical energy-momentum tensor, $\Phi(x) = 0$ is a characteristic surface.

It should be noted that form (2) of the characteristic equation is typical for a broad class enough of nonlinear electrodynamics models (see [12, 13]). But for the Born-Infeld electrodynamics the tensor $\mathfrak{g}^{\mu\nu}$ additionally includes (3) the energy-momentum tensor of the model!

As it is known, if we have some given field $\overset{\circ}{F}_{\sigma\rho}$, the problem for propagation of quick-oscillating wave with small amplitude gives the dispersion relation coinciding with the characteristic equation (2) where $\Phi(x)$ is wave phase and $\mathfrak{g}^{\mu\nu} = \mathfrak{g}^{\mu\nu}(\overset{\circ}{F}_{\sigma\rho})$. Thus the light propagates in the effective Riemann space induced by the given electromagnetic field. Here we have in view some perturbation method and the given field may be a negative-going field of distant particles-solitons. That is in nonlinear electrodynamics we have the light beams distortion which is similar to the gravitational one. In the context of the unified theory such effect is responsible for the real gravitational distortion of light.

The matter is constructed by the charged particles. In classical linear electrodynamics the point charged particle in proper coordinate system has the radial electric filed only $E_r = q/r^2$. (In the article [6] we consider dyons or the particles-solitons with electric and magnetic charges as building blocks of matter but here this is not essential, because we can use always the dual transformation for the change of the electric particle to the dyon.) In linear electrodynamics the energy of such field configuration has infinite value. In nonlinear Born-Infeld electrodynamics the appropriate field configuration has a finite value. Because the matter contains the large quantity of such moving field configurations, it looks as very difficult non-stationary electromagnetic filed configuration.

It is evident, in this approach a stable individual elementary particle must have a time-periodical field configuration in proper coordinate system ($\{y^\mu\}$). Thus we have the following Fourier representation for the freely moving particle in the coordinate system $\{x^\nu\}$:

$$\mathcal{D} = \sum_{f=-\infty}^{\infty} \mathcal{D}_f \, \exp(\imath f \Theta), \tag{4}$$

where $\mathcal{D}$ is column with six components of the electromagnetic field, $\mathcal{D}_f = \mathcal{D}_f(y^i)$, the Latin indices (except f) take values $1, 2, 3$,

$$y^i = L^i_j \left[x^j - a^j(x^0)\right], \tag{5}$$

L^μ_ν are component of Lorentz transformation matrix,

$$a^j = V^j x^0 + a^j_0 \tag{6}$$

is the rectilinear trajectory,

$$\underline{\omega}\, y^0 \equiv \Theta = \Theta(x), \qquad \frac{\partial \Theta}{\partial x^\mu} \equiv k_\mu, \tag{7}$$

and

$$|g^{\mu\nu} k_\mu k_\nu| = \underline{\omega}^2. \tag{8}$$

The field configuration $\mathcal{D}_0$ in (4) is the solitary wave with charge. The movement of simplest such solitons in small given field $\overset{\circ}{F}_{\sigma\rho}$ is considered by the author for Born-Infeld type electrodynamical models in the papers [3] – [6]. Here the given field is small with respect to the maximum value for the field of the soliton under consideration. We obtained the trajectory $a^j(x^0)$ modified by the small given field using an approximate method. The first order by the small field $\overset{\circ}{F}_{\sigma\rho}$ gives the Lorentz force. The second order [3, 4] gives the trajectory in the form of geodesic line equation for some effective Riemann space with metric depending on squares of the field components $\overset{\circ}{F}_{\sigma\rho}$.

The quick-oscillating part of the field configuration (4) (for $f \neq 0$) is some standing wave in proper coordinate system. The simplest example for such standing wave is the function

$$\frac{\sin(\underline{\omega}\, r)}{\underline{\omega}\, r} \sin(\underline{\omega}\, y^0), \qquad r = \sqrt{y^i y_i}, \tag{9}$$

which is the solution for wave equation in spherical coordinate system. If we operate on this function by the Lorentz transformation or consider it in the coordinate system $\{x^\mu\}$ (5) – (8), we obtain the prototype for the quick-oscillating part of (4).

The movement of such semi-standing wave having a small amplitude is considered in my article [6]. The additional given field $\overset{\circ}{F}_{\sigma\rho}$ modifies the originally rectilinear trajectory of the semi-standing wave such that the dispersion relation (8) modifies to the following:

$$|\mathfrak{g}^{\mu\nu} k_\mu k_\nu| = \underline{\omega}^2, \tag{10}$$

where $\mathfrak{g}^{\mu\nu}$ are defined by (3) with $\mathfrak{g}^{\mu\nu} = \mathfrak{g}^{\mu\nu}(\overset{\circ}{F}_{\sigma\rho})$.

Relation (10) is coincide with the Hamilton-Jacobi equation for a massive particle moving in gravitational field. For the case $\underline{\omega} = 0$ we have the dispersion relation for light.

The stated results argue for that the massive bodies, like the light, will move in the effective Riemann space induced by the electromagnetic field of distant bodies.

Now let us consider the following simplest example.

In Newtonian approximation the geodesic line equation for the effective metric has the following form:

$$\frac{\mathrm{d}V_i}{\mathrm{d}x^0} = -\frac{1}{2}\frac{\partial \mathfrak{g}_{00}}{\partial x^i}. \tag{11}$$

Let us extend the above stated results to the case when the space-time metric $g_{\mu\nu}$ corresponds to a gravitational field specified by the Newtonian potential $\varphi < 0$. Thus we have

$$g_{00} = 1 + 2\,\varphi. \tag{12}$$

Let also we have the electromagnetic filed $\overset{\circ}{F}_{\sigma\rho}$. Then according to (3) we have

$$\mathfrak{g}^{00} = 1 + 2\,\varphi - 2\,\varepsilon, \tag{13}$$

where

$$\varepsilon \equiv \frac{\chi^2}{2}\,T^{00} \approx \frac{\chi^2}{4}\left(\overset{\circ}{\mathbf{E}}{}^2 + \overset{\circ}{\mathbf{B}}{}^2\right). \tag{14}$$

Here we take the case when the filed $\{\overset{\circ}{\mathbf{E}}, \overset{\circ}{\mathbf{B}}\}$ is small.

From (11) we have

$$\frac{\mathrm{d}V_i}{\mathrm{d}x^0} = -\frac{\partial}{\partial x^i}\left(\varphi - \varepsilon\right). \tag{15}$$

Because $\varphi < 0$ and $\varepsilon > 0$ then $\varphi - \varepsilon \neq 0$. But we can take the electromagnetic filed $\{\overset{\circ}{\mathbf{E}}, \overset{\circ}{\mathbf{B}}\}$ such that

$$\nabla\left(\varphi - \varepsilon\right) = 0. \tag{16}$$

In this case the gravitation will be compensated by the electromagnetic field. If we have a gravitating massive body such that $\varphi = -\gamma\, M/r$ then this compensation need a counteractive body causing ε. In particular, this can be a charged body or the body with electric current. The necessary magnitude of field strength depends on the dimensional constant χ. One possible way for experimental determination of this constant contains in article [8].

It would appear reasonable that the Newtonian potential φ is caused by the electromagnetic field of neutral bodies. (φ and ε have opposite signs but they are contained in $\mathfrak{g}^{00}$ (12) also with opposite signs, then ε gives correct sign of gravitational interaction.) Here we suppose that the neutral bodies, which are the nonstationary electromagnetic field configurations, are surrounded by the quick-oscillating decrescent at infinity field having wave-lengths of the order of de Broglie ones for the particles of bodies.

We have considered the simplest example but the consideration of more complicated cases can gives new significant and interesting effects connected with the unified approach.

Thus we have the possibility in principle to compensate the gravitation by the considered nonlinear electrodynamics effect. But certainly this problem need following theoretical and experimental investigations.

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ON THE IDEA OF GRAVITATIONAL SHIELDING OF MATTER IN BINARY MODEL

K.N. Sinitsyn[1]

Department of Communication, Special Engineering and Automation, 70, Tulskaya St., Kaluga 248023, Russia

April 27, 2001

It is well known that Einstein prediction of the gravitational waves in 1916 is a perturbations of space-time. We see that in an obtained region of Universe the powerful gravitational waves occures in nature from bursts of supernovaes, collisions of neutrons stars, black holes and in time of non-simmetrical gravitational collapses.
In present days many scientists turn to opportunity of detectors of gravitational waves for proof of truth Einsteins prediction.
In this connection is proposed the analysis of structure of the gravitational waves as a quadrupole derivation of two types of gravitons — quick and slow — within of the binary model of distribution of the density substance which was shown in earlier papers.
This poin of view allows to speak that gravitational waves (radiation) is complex type of interaction which we find as gravity phenomenon because one type of action gravitons on the substance is less, than other type of action. In the mean time, the quick gravitons in the binary model are real cadidates on the role of particles for shielding of gravitational interaction of matter.
Comparison of the model of detector in the binary model and in standart theory allows to speak about new opportunities to detect of gravitational waves in detectors of first generation.

1. Introduction

It is expected that ground based detectors of first generation with using of laser interferometers allows to find of gravitational waves if signal more than noise [5].

In the mean time still not clear fate of Universe: acceleration forever or slowdown and collapse in future.

In this connection is very importantly knownledge about nature of gravity. The data of observation show that simple gravity not give clear picture for Universe. This means that the Universe needs in additional gravity as a "dark matter" or something other, but main question still remains in the nature of gravity [16].

In early papers was shown [3,4] that the binary model of distribution of the density substance gives new model for nature of gravity and well agreement with modern cosmological models. This allows to use the predictions on detection of gravitational waves such that is expected [5,16] with comparison with predictions of the binary model. As show in this analysis, the binary model gives more fundamental explanation of nature of gravity and gravitational radiation that allows to speak about complex interactions which give the gravity in result. In this new model exists essential difference from standart theory: the parameters of space-time is defined in common parameters of density, velocity, length and time. It is more complex basis then in standart theory, but it is essentially gives simple algorithm for all future calculations.

[1] e-mail: koscmp@kaluga.ru

2. The formula of Newton gravity in binary model of distribution of the density substance

As show in [4], the constant of Newton gravity in common case is defined as

$$G = \frac{1}{\Delta\rho \times \Delta\tau^2} \tag{1}$$

and the Newton gravity is defined through effective potential of mass and its distribution in space-time as

$$F_{gr} = G\frac{M_1 \times M_2}{R^2} = \\ = \frac{1}{\Delta\rho \times \Delta\tau^2} \times \gamma_1^M \times \gamma_2^M \times V_{effM}^2 \tag{2}$$

when

$$\gamma_1^M = func(\frac{M_1}{R}), \gamma_2^M = func(\frac{M_2}{R}) \tag{3}$$

where

$$V_{effM} = \frac{M}{r \times K_{form}} = \frac{m_{Pl}}{l_{Pl}} = \frac{c^2}{G} \approx$$

$$\approx 1,35 \cdot 10^{27} \text{ kg/m} \tag{4}$$

is universal constant in binary model.

In accordance with conception of binary model about nature of gravity, the gravitational radiation is result complex interaction of two different types of particles - quick (qk) and slow (sl) gravitons [4]. Slow and quick gravitons is particles with one marked gravitational change that is the mass. But slow gravitons are formed in waves of expansion on borders of groups that quasi- closed. Therefore summary action of slow gravitons have direction to center of gravitational mass. Summary action of quick gravitons have direction from this center because it formed in reflected waves on borders of groups that quasi-closed.

This fact is main to understanding of nature quadrupole derivations of gravitational waves in binary model.

Thus, the binary model create a new class of interactions, when gravity is result of summary actions between slow and quick gravitons. And in essense the meaning of gravity charge is defined in the marking of Newton gravity constant: either minus (ordinary gravitation) or plus (anti- gravitation).

We can analyse the behaviour of Newton gravity constant in different boundaries conditions.

In common case

$$\Delta\rho\Delta\tau^2 = (\rho_{sl,gr} - \rho_{qk,gr})(\tau_{sl,gr} - \tau_{qk,gr})^2 \tag{5}$$

Performing ordinary mathematical actions and grouping in class of interactions gives next equations

$$\frac{V_{eff}}{c^2} = \gamma_G, \frac{\rho_{sub}}{\rho_{inv}} = \gamma_\rho, \frac{\rho_{sub,max}}{\rho_{sub,min}} = \Delta_\rho \tag{6}$$

$$\rho_{sl,gr}\tau^2_{sl,gr} - \rho_{qk,gr}\tau^2_{qk,gr} = \gamma_G(\gamma_{\rho,sub} - \frac{\rho_{sub,max}}{\rho_{sub}}) \tag{7}$$

$$\rho_{sl,gr}\tau^2_{qk,gr} - \rho_{qk,gr}\tau^2_{sl,gr} = \gamma_G(\Delta_\rho\gamma_{\rho,sub} - \frac{\rho_{sub,min}}{\rho_{sub}}) \tag{8}$$

$$2\tau_{sl,gr}\tau_{qk,gr}(\rho_{qk,gr} - \rho_{sl,gr}) = \\ = 2 \times \Delta_\rho^{5/2}\gamma_G(\frac{\rho_{sub,min}}{\rho_{sub}} - \gamma_\rho) \tag{9}$$

From (7)...(9) we can see that all three components of Newton gravity constant not equal zero. Then a) - for global region of space-time in binary model

$$(\rho_{sub}, \rho_{inv}) \to \rho_{sub,min} \tag{10}$$

and in limit

$$\rho_{sl,gr}\tau^2_{sl,gr} - \rho_{qk,gr}\tau^2_{qk,gr} \to -\Delta_\rho\gamma_G \tag{11}$$

$$\rho_{sl,gr}\tau^2_{qk,gr} - \rho_{qk,gr}\tau^2_{sl,gr} \to +\Delta_\rho\gamma_G \tag{12}$$

$$2\tau_{sl,gr}\tau_{qk,gr}(\rho_{qk,gr} - \rho_{sl,gr}) \to 0 \tag{13}$$

We can see in this case that first component for global region of space-time is negative (11), second (12) - positive. Difference between first and second components less, than less the density of substance. The mark of third component is defined from next rule

$$\rho_{sub} > \sqrt{\rho_{inv} \times \rho_{sub,min}} \to (13)-, \tag{14}$$

$$\rho_{sub} < \sqrt{\rho_{inv} \times \rho_{sub,min}} \to (13)+ \tag{15}$$

The sum of all three components is negative, but less than less the density of substance. And in limit it is defined in double size of substance fluctuations. b) - for collapsing region of space-time in binary model

$$(\rho_{sub}, \rho_{inv}) \to \rho_{sub,max} \tag{16}$$

and in limit

$$\rho_{sl,gr}\tau^2_{sl,gr} - \rho_{qk,gr}\tau^2_{qk,gr} \to 0 \tag{17}$$

$$\rho_{sl,gr}\tau^2_{qk,gr} - \rho_{qk,gr}\tau^2_{sl,gr} \to +\Delta_\rho\gamma_G \tag{18}$$

$$2\tau_{sl,gr}\tau_{qk,gr}(\rho_{qk,gr} - \rho_{sl,gr}) \to -2 \times \Delta_\rho^{5/2}\gamma_G \tag{19}$$

We can see for this case that first (17) component for collapsing region of space-time is defined from next rule

$$\rho_{sub} > \rho_{inv}\rho_{sub,max} \to (17)+ \tag{20}$$

$$\rho_{sub} < \rho_{inv}\rho_{sub,max} \to (17)- \tag{21}$$

and if density of substance increase to maximum, then the first component is zero (in reality it is double size of substance fluctuations). The second component (18) is positive, but third component (19) is negative. The sum of all free components is negative till moment then positive pressure of light exceed negative pressure of gravity. For binary model this condition is calculated in next equation

$$\frac{V^2_{effM}}{r^2} \times \frac{\rho^{5/2}_{sub,min}c^2}{2\rho^{5/2}_{sub,max}V_{effM}} \leq \rho_{sub,max}c^2 \tag{22}$$

or

$$r^2 \geq \frac{V_{effM}\rho^{5/2}_{sub,min}}{2\rho^{7/2}_{sub,max}} \tag{23}$$

c) - for fractal region of space-time in binary model

$$\rho_{sub} \to \rho_{sub,max}, \rho_{inv} \to \rho_{sub,min} \tag{24}$$

and in limit

$$\rho_{sl,gr}\tau^2_{sl,gr} - \rho_{qk,gr}\tau^2_{qk,gr} \to +\Delta_\rho\gamma_G \tag{25}$$

$$\rho_{sl,gr}\tau^2_{qk,gr} - \rho_{qk,gr}\tau^2_{sl,gr} \to +\Delta^2_\rho\gamma_G \tag{26}$$

$$2\tau_{sl,gr}\tau_{qk,gr}(\rho_{qk,gr}-\rho_{sl,gr}) \rightarrow -\Delta_{\rho}^{7/2}\gamma_G \quad (27)$$

We can see for the case fractal region of space-time that mark of the first component (25) is defined in rule (20),(21), the second component (26) is positive, but third component (27) is negative. The sum of all three components is defined in marks of second and third components and in limit is negative.

Now we can see that common case for Newton constant of gravity include linear and non- linear terms which is useful for explanations Newton or non-Newton gravity (for example effect of Kazimir), post-Newton gravity (quadrupole radiation, effect of moving mass, etc.). The commom case for constant of Newton gravity is in following view

$$\frac{1}{G} \approx \gamma_G[2\Delta_{\rho}^{5/2}(\frac{\rho_{sub,min}}{\rho_{sub}}-\gamma_{\rho})-\frac{\rho_{sub,max}}{\rho_{sub}}] \quad (28)$$

Then, making changing and grouping we have in result negative value of constant of the Newton gravity and ordinary gravity if

$$\rho_{sub}^2 \geq \rho_{inv}\rho_{sub,min}(1-0,5\rho_{sub,min}^{3/2}\rho_{sub,max}^{-3/2}) \quad (29)$$

or for Sun system with data of measurement barionic density of substance [8],[11],[14],[18]

$$\rho_{sub} \geq (1,83 \div 2,04)\cdot 10^{-14} \times \sqrt{\rho_{inv}} \quad (30)$$

In other case the constant of Newton gravity is positive and gravity is realised in "anti- gravity" or shielding of gravitational interaction of matter.

3. Gravitational waves in binary model of distribution of the density substance. Additional opportunities for detection (resonant frequencies)

In the binary model gravitational radiation occurs not only in time when changing marking acceleration, but in time of every acceleration.

On today the electromagnetic radiation is well known. On example of interaction between electromagnetic and gravitational radiation we can demonstrate position of the binary model about nature and interinfluence for different type of interaction. In first, the gravitational waves carry energy and pulse. About energy this shown in [4], but for pulse we will rewrite equation (2) in following view

$$F_{gr} = Mv_{gr}\nu_{gr} \quad (31)$$

where parameters of mass, velosity and frequency is common for all system of bodies. In this approach constant of Newton gravity and Planck is defined through one set of parameters

$$G = \frac{c^2}{V_{effM}}, C_M = l_{Pl} \times V_{effM}, h = \frac{G \times C_M^2}{c} \quad (32)$$

Using formula for frequencies of electromagnetic and gravitational radiation from frequency matrix in [4] we set in result that gravitational field fluctuated with zero modes without gravitons as electromagnetic field of "physical vacuum" without photons. In terms of binary model this fact fixed in next equations

$$E_{el,0} = \frac{1}{2}h\nu_{el,min} \quad (33)$$

$$E_{gr,0} = \frac{1}{2}M_{gr}c^2\rho_{sub,min}\rho_{sub,max}^{-3/2}V_{effM}^{1/2} \quad (34)$$

where

$$\nu_{el,min} = \nu_{sl,gr}, M_{gr} = V_{effM}^{3/2}\rho_{sub,min}^{-1/2} \quad (35)$$

In the mean time the charge in well-known formula is defined as

$$2\pi \times e^2 = \alpha \times h \times c \quad (36)$$

But in terms of binary model the charge is defined as

$$2\pi \times e^2 = \alpha \times C_M c^2 \times c \times \Delta\tau_1 \quad (37)$$

where

$$\Delta\tau_1 = \frac{l_{Pl}}{c} \quad (38)$$

Now we can see that nature of charge is in process of diffusion on the borders of quasi-closed groups for Planck's scale. And the mark of electrical charge is defined through mark of interval of time. But for gravitational charge (mass) the mark is one and it is defined through interval of space. The difference for marks of energy of quick and slow gravitons is defined not due to difference of mark for gravitational charge, but due to difference of direction of sum pulse for quick and slow gravitons. And it is calculated in mathematical plan in next part.

Thus, in binary model the nature of quadrupole for gravitational waves and gravitational field is quantum relatively gravitons status. In adding the gravity in all cases in binary model is parameter of function distribution of the density substance. Consequently, the gravitational mass in binary model is exactly proportional from inertial mass till to mark of density gradient of system substance of bodies. For example, from (30) we set consequence that for Sun system this principle will true not less than till 10^{-14}. In the mean time, in binary model the gravitational detector is every substance that have ability to reaction on the action of gravitational waves. In such approach the detector is resonant circuit with known parameters of change of curvature and energy. Calculations that made in binary model gives two band of resonant frequencies

$$\Delta\nu_1 \approx 10^{-3} \div 7\cdot 10^{-3}, \Delta\nu_2 \approx 10^{-6} \div 8\cdot 10^{-5}(Hz) \quad (39)$$

for concentration gradient $\delta\rho_{sub} \approx 2 \cdot 10^5$ and for interval of velocities from 464 to 10000 meter per second. Comparing these results with standart theory [5,(15-24)] we can propose that for ground based detector we would see the peak of registrations on the band of frequencies

$$\Delta\nu_{reg,max} \approx 10^{-2} \div 10^{-3}(Hz) \tag{40}$$

and these signals would be not from Galaxy, but only outside of Galaxy. For cases of merging of black holes these signals would be concetrated in vicinity from frequency 10^{-5} Hz.

In adding the difference of amplitude for gravitational waves in binary model is as a result of detection different types of gravitational waves:

— ordinary gravitational waves (GW);

— the gravitational waves that is induced from magnetic fields of astrophysical objects$(GW, magn)$;

— the gravitational waves that is induced from electrical fields of astrophysical objects (GW, el).

In this means the probability of detection for ordinary gravitational waves more less than for gravitational waves that is induced from electrical of magnetic fields of astrophysical objects. The standart theory not see such cases, because not able to select it.

4. Spectra of gravitational waves and sensitivity of detector in binary model of distribution of the density substance

The analysis in parts 2,3 show that binary model not change the point of view on the gravitational field as result of sum of many frequencies of oscillations. But this means in binary model that standart theory with coordinates parameters not reflect complete statuses of gravitational waves. Therefore calculations in binary model for amplitude of gravitational signals made on basis of other equations than in standart theory. For ordinary gravitational waves:

$$\frac{E_{GW,qk}}{M_{qk,gr}c^2} = \frac{R_{qk,gr}\rho^2_{sub}}{\sqrt{V_{effM}\rho^3_{sub,max}}} \tag{41}$$

$$\frac{E_{GW,sl}}{M_{sl,gr}c^2} = \frac{R_{sl,gr}\sqrt{\rho^3_{inv}}}{\sqrt{\rho_{sub}\rho_{sub,max}V_{effM}}} \tag{42}$$

For gravitational waves that is induced from magnetic fields of astrophysical objects:

$$\tau = \sqrt{\frac{V_{effM}}{\rho_{sub}}c^2}, \gamma^1_\rho = \sqrt{\frac{1}{\rho_{sub}\rho_{sub,max}}} \tag{43}$$

$$\gamma^2_\rho = \frac{\rho^2_{sub}}{\rho_{sub,max}}, \gamma^3_\rho = \sqrt{\frac{\rho^2_{inv}}{\gamma_\rho}} \tag{44}$$

$$-\frac{E^{qk,\tau}_{GW,magn}}{M_{qk,gr}c^2} = \gamma^1_\rho[(c+2\tau)\gamma^2_{rho} - c\gamma^3_\rho] \tag{45}$$

$$+\frac{E^{sl,v}_{GW,magn}}{M_{sl,gr}c^2} = \gamma^1_\rho[\tau\gamma^2_\rho - (2c+\tau)\gamma^3_\rho] \tag{46}$$

For gravitational waves that is induced from electrical fields of astrophysical objects:

$$-\frac{E^{qk,v,\tau}_{GW,el}}{M_{qk,gr}c^2} = \gamma^1_{rho}[2c\gamma^3_\rho + (2c + 2\tau\rho_{sub,max}\sqrt{\gamma^2_\rho})] \tag{47}$$

$$+\frac{E^{sl,v^2}_{GW,el}}{M_{sl,gr}c^2} = \gamma^1_\rho[(2\tau + 6c\rho_{sub,max})\gamma^3_\rho + 2\tau\gamma^2_\rho] \tag{48}$$

The distribution of frequencies for detector is calculated in next system of equations

$$\eta = \theta \times \log(\frac{\rho_i}{\rho_j}), \cos(\eta) = A, tg(\eta) = B \tag{49}$$

where A is parameter of change of space-time curvature, B is parameter of velocity of changing space-time curvature

$$W_4 = Mc^2, R_{gr-res} =$$

$$= A \times \frac{W_4}{M_{sub}gr_{har} + 0,5M_{sub}v^2} \tag{50}$$

$$-D = \frac{\log(M_{sub}gr_{har} + 0,5M_{sub}v^2)}{\pi\tau\log(e)} \tag{51}$$

$$L_{gr-res} = \frac{R_{gr-res}}{2\pi D}, C_{gr-res} = \frac{B + D^{-1}}{2\pi R_{gr-res}} \tag{52}$$

$$\gamma_{LC} = \frac{1}{L_{gr-res}C_{gr-res}}, \gamma_{RL} = \frac{R_{gr-res}}{2L_{gr-res}} \tag{53}$$

$$\nu_{gr-res} = \frac{1}{2\pi}\sqrt{\gamma^{-1}_{LC} - \gamma^2_{RL}} \tag{54}$$

$$\rho_{rms} \geq 2\rho_{sub,min} \rightarrow \rho_{ideal,i,\theta,\psi,\phi} \tag{55}$$

The real gravitational signal in binary model such weak as and in standart theory. Therefore in binary model detect of gravitational waves also is carried out in method of accumulation. Nevertheless, existence of bands of the resonant frequencies is positive factor in binary model. In these bands probably exist amplifications for gravitational signals that exceeds losing from noises of temperature. This prediction requires additional proof, but in reality today the binary model require less of calculation power than the standart theory.

5. Brief conclusions

Thus, in the binary model we can see that electrical and gravitational charge is charge of different nature:

— the electrical charge occurs from fluctuations of time (or distribution of density substance in time) on the Planck's scale;

— the gravitational charge (the mass of body) occurs from fluctuations of space (or distribution of density substance in space).

In the mean time, the electrical charge exist in two marks: positive and negative. Consequently, the electromagnetic radiation is defined in structure of dipole. But the gravitational charge exist only in one mark, and difference of mark of energy for quick and slow gravitons is defined only difference of mark of pulse in interaction with substance, because slow gravitons are formed in waves of expansion, but quick gravitons are formed in waves of collapse (compression).

As shown in analysis, the binary model allows estimate the oppurtunity of detection of the gravitational waves with more accuracy than the standart theory. Such approach to nature of gravitational waves probably gives that so called "short waves of modes" of gravitational signals are waves that are induced from electrical or magnetic fields of astrophysical objects, but not ordinary gravity in common means. Consequently is need is increase of sensitivity of detectors for detection in future of ordinary gravity. In all cases the gravity in binary model is result of sum of the ordinary gravity and of shielding of the gravitational interaction. This fact demostrate more fundamentally the nature of gravitational waves as quadrupole, but detection of separate components of gravitational wave still not possible, because its amplitude on 1-2 order less, than amplitude of ordinary gravitational wave (see sect. 2).

At last, the binary model allows to unify the methods of calculations that decrease the requirements to calculation power and, in result, decrease of costs of all series of all experiments to detect gravitational waves.

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ON THE MASS OF ELEMENTARY CARRIERS OF GRAVITATIONAL INTERACTION

Volodymyr Krasnoholovets[1]

Institute of Physics, National Academy of Sciences, Prospect Nauky 46, UA-03028 Kyïv, Ukraine
http://inerton.cjb.net

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Based on the theory of submicroscopic quantum mechanics recently constructed by the author the mass of elementary spatial excitations called inertons, which accompany a moving particle, is estimated herein. These excitations are treated as carriers of both inertial and gravitational properties of the particle.

Key words: space, inertons, mass, inertia, gravitation

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In a series of recent papers by the author [1-4] submicroscopic quantum mechanics has been constructed. It easily results in the Schrödinger and Dirac formalisms on the atom scale. The theory has predicted the existence of peculiar spatial excitations around a moving particle. Those excitations have been identified with a substructure of the matter waves and been called "inertons". The theory has successfully been verified experimentally, namely, it has been demonstrated how inertons manifest themselves in numerous experiments [5] and, moreover, inertons have been recorded in our experiments as well [6-8].

Detailed theoretical consideration [1-5] of the motion of a canonical elementary particle in a real space that is characterized by a submicroscopic structure (and the particle is a an element of the space as well), allows an evaluation of the value of mass of elementary excitations – inertons – of a space substrate (i.e. quantum aether).

Elementary excitations of the space substrate are created due to collisions of a moving particle by superparticles – primary cells of the structure of the real space. The excitations were called inertons [1] because, in essence, they reflex inert properties of the particle, i.e. inertons appear owing to the resistance which the particle experiences at its motion on the side of the space substrate that in turns is specified by quantum properties. Amplitude Λ of the particle's inerton cloud that surround the moving particle obeys the relationship [1]

$$\Lambda = \lambda \frac{c}{v_0} \tag{1}$$

where λ its de Broglie wavelength and the initial velocity v_0, respectively, and c is the velocity of light.

According to author's concept [1-5], a particle is created from a degenerate superparticle. Therefore a particle should be treated as a local curvature of the space. The notion of the mass is associated with the alteration of an initial volume of the mother superparticle. Around a particle, a deformation coat, or crystallite, is formed that consists of superparticles which possess mass. Beyond the crystallite superparticles are massless. Thus the crystallite plays the role of a screen that shields the particle from the degenerate space substrate. The total mass of massive superparticles of the crystallite is equal to the mass m_{v_0} of the particle [4], which is found in the center of the crystallite. The size of the crystallite is estimated by the length of the Compton wavelength $\tilde{\lambda}_{v_0} = h/m_{v_0}c$. As the solid state physics teaches, the availability of the crystal structure automatically implied the appearance of elementary vibrational excitations in the crystallite [4].

Inertons should be considered as a substructure of the matter waves [3-5]. In papers [1,2,4] it has been noted that the energy of an emitted inerton is directly proportional to the energy of the particle that the particle had had at the moment of the collision with the vibrating mode of the crystallite. Both the energy of the particle and that of the mode decrease from collision to collision. Therefore the same should occur for emitted inertons: the energy of the $(i+1)$th inerton less than the energy of the $i$the one. Since we believe that the initial velocity of emitted inertons has the order of the velocity of light c, we should conclude that the mass of emitted inertons gradually decreases

[1] e-mail: krasnoh@iop.kiev.ua

as well, i.e. $m_{i+1} << m_i$.

For instance, if the velocity of the particle $v_0 \ll c$, then the inequality $m_i > m_{\rm cr}$ holds in the beginning, where $m_{\rm cr}$ is the average mass of the crystallite's superparticle. In other words the inequality is correct at a small value of i (we recall that $i = \overline{1, N}$ where N is the total number of collisions of the particle along its half de Broglie wavelength $\lambda/2$. In this case amplitude Λ_i of the ith emitted inerton prevails the crystallite size, $\Lambda_i \gg \tilde{\lambda}_{v_0}$.

However, as the index i increases, the inerton mass diminishes and reach values less than the mass of crystallite's superparticles, $m_i < m_{\rm cr}$. In this case the amplitude of the inerton has a magnitude under the crystallite size, $\Lambda_i < \tilde{\lambda}_{v_0}$.

The average mass $m_{\rm cr}$ of a superparticle in the crystallite can be estimated. For example, in the case of a nonrelativistic electron the Compton wavelength $\tilde{\lambda}_0 = 2.42 \times 10^{-10}$ cm. If we divide the crystallite volume $\tilde{\lambda}_0^3$ by the volume of a superparticle $\mathcal{V} \sim (10^{-28})^3$ cm^3, we will get the number of superparticles in the crystallite $N_{\rm in\ crys.} \sim 10^{55}$. Since the mass of the crystallite is taken to be the mass of the particle, we will obtain the following value for the mass of a crystallite's superparticle: $m_{\rm cr} = M_0^{\rm electron}/N_{\rm in\ crys.} \sim 10^{-85}$.

We can also evaluate the mean mass $\bar{m}_{\rm in}$ of an emitted inerton. For this purpose we should divide the total mass $\Delta M = (M_0/\sqrt{1 - v_0^2/c^2} - M_0)$ of the emitted inerton cloud by the number of emitted inertons $N = \lambda/\mathcal{V}^{1/3}$ (we recall that the cloud is emitted along the first half de Broglie wavelength $\lambda/2$, then it is absorbed in the next section $\lambda/2$ of the particle path, and so on).

Setting v_0 equals $0.01c$ to $0.999c$, we obtain:

$$\begin{aligned} \bar{m}_{\rm in} &= \frac{M_0/\sqrt{1 - v_0^2/c^2} - M_0}{\lambda/\mathcal{V}^{1/3}} \\ &= 10^{-57} \text{ to } 10^{-45} \text{ kg}. \end{aligned} \tag{2}$$

In the case of inertons emitted by atoms which vibrate in a solid, $\bar{m}_{\rm in}$ falls in the broad range between values (2) and about $\sim 10^{-70}$ kg (at the extremely low atom velocity $v_0 \sim 1\ \mu$m/s).

The value of mass of carriers of a peculiar interaction between objects was estimated also by other researchers. For instance, Kolpakov [9] studying experimentally a nonelectromagnetic interaction from both extrasensitive participants and objects of abiotic environment proposed a pure classical mechanism of the propagation of excitations of an aether substance; his model yielded evaluation $\sim 10^{-73}$ kg for the mass of carriers of the revealed interaction.

Starting from the field formulation of the general theory of relativity Zhuk [10] obtained for his "gravitons", carriers of the gravitational interaction, mass $\sim 10^{-69}$ kg. It is interesting that this magnitude is approximately equal to an average value between mentioned inerton masses $m_{\rm cr}$ and $\bar{m}_{\rm in}$.

Thus, it can be concluded based on submicroscopic quantum mechanics that the value of mass of carriers of the inertial/garvitational interaction is not strongly fixed. Masses of inertons emitted and then absorbed by a moving particle is distributed in a wide spectral range (note that a similar situation occurs in the case of the electromagnetic radiation: the photon frequency can vary from practically zero to the frequency of γ-quantum and above).

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TOWARDS THE ETHER THEORY (APOLOGY OF THE ETHER)

S.A. Sannikov-Proskuryakov[1]† M.J.T.F. Cabbolet[2]‡

† *Kharkov Institute of Physics and Technics, Kharkiv, Ukraine*

‡ *Institute of Fundamental Investigations "Liberalitas", Eindhoven, Holland*

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It is demonstrated that the ether idea is to be in agreement with all experimental data supporting the special relativity: at the pure kinematic level the addition of ether to the Galileian space $M_3 \otimes M_1$ transforms this into the Minkowski space $M_{3,1}$. It turns out that the reason of this property of ether is the Heisenberg algebra $h_8^{(*)}$ underlying the dynamical theory of ether. At this more deep dynamical level ether is a source of all forms of matter (fundamental particles and their interactions) and of the space-time continuum.
In the 20th century, without fundamental reason, two serious mistakes were made: rejection of the ether idea from physics and, as a result, the introduction of so called non-proper functions. Ultraviolet divergences in quantized field theory originate from these mistakes; they caused the nowadays clearly observable halt in the development of physics.

1. Introduction

As an explanation of the results of the well known Michelson-Morley and Fizeau experiments and developing high velocity mechanics, Lorentz suggested a very important idea about spatial contraction in the direction of motion [1] (so called Fitz Gerald-Lorentz contraction). Being a great physician Lorentz understood that the physical reason of this phenomenon is found in the *special medium filling the space-time continuum* M_4 which he called ether. Before Lorentz, ether played the role of light-carrying medium (Newton [2], Maxwell [3], Larmor [4]). However only the Lorentz theory led to the observable effects: space contraction and time dilation (Lorentz [1], Poincare [5]).

Ancient philosophers too came to the notion of a special medium, which they called quintessence, prematter or also ether [6], from which the present forms of matter are supposed to be arisen. Mankind very long time pondered over this greatest hypothesis.

The pure phenomenological description of particle motion and light radiation in an ethered space resulted often in contradiction with experiments. This permitted Einstein to reject the ether idea and to base special relativity on a pure geometrical consideration [7] - later on Einstein returned to the ether image but that was no longer the Lorentzian ether.

It is emphasized however that geometry is not physics (at least not the whole physics) and physics is not geometry at all (permitting certain liberty of speech we can say that physics = geometry + algebra).

The pure geometrical approach to physics is, of course, insufficient: the notion of ether can be maintained by another proper mathematical language. Therefore it is preferable to separate the *physical aspects* of special relativity (Lorentz-Poincare) from its formal *axiomatic formulation* (Einstein-Minkowski).

Here it will be demonstrated that the physical meaning of relativity is the one suggested by Lorentz: the ether is a special medium filling the space-time continuum M_4 . Einstein's pure geometrical approach to the description of this continuum is only a *phenomenological approximation* to the problem. There exists the *microscopic theory* of ether (see below). These two theories, therefore, are quite different and there is an experiment (creation of particle downpour) which permits to distinguish them. But at pure geometrical level these two theories coincide of course.

2. Geometrical approach

The ether drama unfolded as follows: Newtonian mechanics were based on the Galileian space-time $M_3 \otimes M_1$ where M_3 is a three dimensional space with scalar product (dX, dY) or distance $ds = \sqrt{(dX, dX)}$; M_1 is a carrier of time. The symmetry group of M_3 is the rotation group $SO(3)$. The symmetry group of the whole Galileian space $M_3 \otimes M_1$ is the Galileian group $Ga(3,1)$, which includes $SO(3)$ and the so called proper Galileian transformations (boosts) $dX \to dX' = dX + vdt$, $dt \to dt' = dt$ where v is the velocity of the dotted coordinate system relative to an undotted one. The Galileian symmetry of the space $M_3 \otimes M_1$

[1]e-mail: sanpros@kipt.kharkov.ua
[2]e-mail: m.cabbolet@wxs.nl

expresses the relativity principle of mechanical motion of matter.

The Galileian invariant metric in the space $M_3 \otimes M_1$ is written in the form of $ds^2_{Ga} = g^{Ga}_{\mu\nu} dX_\mu dX_\nu$ where

$$g^{Ga}_{\mu\nu} = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix},$$

i.e. we have $ds^2_{Ga} = dt^2$. In the special coordinate system (when the dotted system moves relative to the undotted one in the z-direction with velocity v) the matrix of proper Galileian transformation $dX_\mu \to dX'_\mu = V^{Ga}_{\mu\nu} dX_\nu$ is written as

$$V^{Ga} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & v \\ 0 & 0 & 0 & 1 \end{pmatrix} \tag{1}$$

It is well known that observable optical phenomena can not be described in the framework of the Galileian space: Maxwell's equations of electromagnetic fields grabbed from the ether postulate [3,1] are not invariant under the Galileian group [1,5]. From this the following question concerning the properties of ether filling the space $M_3 \otimes M_1$ had arisen: *what is the effect of the presence of ether in Galileian space such that it accommodates the electromagnetic theory* ? The answer, resulting from the Lorentz [1] and Poincare [5] investigations, is well known: the presence of ether transforms the Galileian space into the Poincare-Minkowski space. They demonstrated that the symmetry group of the Maxwell equations is the proper Lorentzian group $SO(3,1)$. Soon after this a space-time with such a symmetry (labeled as $M_{3,1}$) was discovered by Poincare [5] and Minkowski [8]. The Poincare-Minkowski $SO(3,1)$-invariant metric is written in the form $ds^2_{PM} = g^{PM}_{\mu\nu} dX_\mu dX_\nu$ where

$$g^{PM}_{\mu\nu} = \begin{pmatrix} -1/c^2 & 0 & 0 & 0 \\ 0 & -1/c^2 & 0 & 0 \\ 0 & 0 & -1/c^2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix},$$

i.e. $ds^2_{PM} = dt^2 - \frac{1}{c^2}\left(dX^2 + dY^2 + dZ^2\right)$ [1]. In a special coordinate system (when the dotted system moves relative to the undotted one in the z-direction with velocity v) the matrix of a proper Lorentzian (or Voigt-Larmor-Lorentz) transformation $dX_\mu \to dX'_\mu = V^L_{\mu\nu} dX_\nu$ is written as

$$V^L = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1/\sqrt{1-v^2/c^2} & v/\sqrt{1-v^2/c^2} \\ 0 & 0 & v/c^2\sqrt{1-v^2/c^2} & 1/\sqrt{1-v^2/c^2} \end{pmatrix} \tag{2}$$

If $v << c$ (2) transits into (1).

It is natural to connect the fluent change of geometry (and its symmetry) from $M_3 \otimes M_1 (v << c)$ to $M_{3,1} (v \leq c)$ with the properties of the medium through which a body moves. And proceeding from (2) and (1) this can be described as

$$M_3 \otimes M_1 + ether = M_{3,1} \tag{3}$$

or on the metric level. From here it follows that

$$g^E_{\mu\nu} = \begin{pmatrix} -1/c^2 & 0 & 0 & 0 \\ 0 & -1/c^2 & 0 & 0 \\ 0 & 0 & -1/c^2 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}.$$

Hence at this pure geometrical level ether is described by the metric tensor $g^E_{\mu\nu}$. In general we could consider $g^E_{\mu\nu} = g^E_{\mu\nu}(X)$ but usually this medium (ether) is considered to be a homogeneous and isotropic entity. We see that even at metric level ether is needed.

We would like to emphasize that $M_3 \otimes M_1$ and $M_{3,1}$ are different formations of one and the same four dimensional continuum M_4 [2], whereas the so called principle of relativity is connected with both the symmetry group of $M_3 \otimes M_1$ and of $M_{3,1}$: in the first case it is expressed by $Ga(3,1)$ and in the second case by $SO(3,1)$.

It is plain to see that ether changes (renormalizes) the Galileian metric $g^{Ga}_{\mu\nu}$ turning it into the Poincare-Minkowski metric $g^{PM}_{\mu\nu}$. Hereby it is considered that only $g^{PM}_{\mu\nu}$ is observed (Poincare principle of relativity) but the "bare" metric $g^{Ga}_{\mu\nu}$ is used in the limiting case of small velocities v (Galileian principle of relativity). Only in this case the effect of ether is neglectable, which of course does not mean that ether then does not exist. In this connection Newtonian mechanics were reconstructed by Lorentz and Poincare into mechanics of high velocities or relativistic mechanics.

The fact that the observable metric is always the sum $g^{Ga}_{\mu\nu} + g^E_{\mu\nu}$ (never the isolated terms) caused Einstein's irresponsible rejection of the physical notion of ether; he considered it to be "scaffoldings", to be removed when the object is built. However, finding the fit geometry (pseudoeuclidean space $M_{3,1}$ with symmetry group $SO(3,1)$) does not allow the conclusion that

[1] One considers that $g^{PM}_{\mu\nu}$ is a metric of "empty" space-time (without matter but with ether). At classical level space-time filled by matter is described by the well known Riemann-Friedmann metric $g^{RF}_{\mu\nu}$. Such a description is connected with co-tangent fibration of space-time (see further).

[2] Of course it is needed to distinguish the Minkowski *vector* space $R_{3,1}$ with symmetry group $SO(3,1)$ (homogeneous Lorentz group) from the Poincare *affine* space $A_{3,1}$ with symmetry group $P = SO(3,1) \times T_{3,1}$ (inhomogeneous Lorentz or Poincare group) where $T_{3,1}$ are translations $dX_\mu \to dX_\mu + a_\mu$.

the truth concerning ether is definitively found. Obviously, physics is connected not only with geometry but also with algebra: it is hereby stated that the pure geometrical point of view, underlain by macroscopic (phenomenological) considerations, is not complete. It embraces only the external or, if we may say so, the "visible surface" of ether. Our point is that there exists another hidden (underground) part; a consideration of its algebraic description will now be discussed. In order to deal with micro structure of ether is needed to penetrate to the very small distances where geomwtrical assumptions lose the validity.

3. Algebraic approach

First of all there are at present three clearly distinct levels of matter description. These are:
i) classical (Newtonian mechanics),
ii) quantum 1 (Schroedinger wave mechanics),
iii) quantum 2 (quantized field theory).

The classical (or macro) level is characterized by wide usage of geometry: particle motions are described by trajectories in space-time $M_{3,1}$, here the presence of matter in space-time leads to the change of its metric $g_{\mu\nu}$ (see footnote 1). The co-tangent fibration $(M_{3,1}, T^*M_{3,1})$ of space-time $M_{3,1}$ is used as a model of the phase space of the dynamical system (particle) and as carrier of the space-time metric.

The quantum (or micro) level is characterized by wide usage of algebra. It should be noted that the transition from classical to quantum level is connected with a transition from the co-tangent fibration $(M_{3,1}, T^*M_{3,1})$ to a tangent one $(M_{3,1}, TM_{3,1})$ (the latter is an algebra): in order to describe the quantum canonical variables of matter and the inner symmetry properties of particles - spin, isospin and so on - it was necessary to consider the so called material (vector) fibration $(M_{3,1}, S)$, where $S = \bigoplus_{\Sigma} S^{\Sigma}$ is the sum of partial fibers. Among the S^{Σ} the most fundamental is the Dirac or spinor fiber $S_8^{(*)}$, elements of which are Dirac's bispinors ψ, $\bar{\psi}$.

In this scheme fibers, being directly connected with matter, play a more fundamental role in the theory then the base $M_{3,1}$ (empty space, i.e. without matter). Cross sections of material fibrations are local fields of fundamental particles $\psi^{\Sigma}(X)$ $\left(\psi^{\Sigma} \in S^{\Sigma},\ X \in M_{3,1}\right)$. However, this local scheme does not qualify as the mathematically consequent description of matter as its second quantized version (quantum 2 level) gives rise to the fundamental troubles of ultraviolet divergences. Aiming at the removal of these problems, the structure of spinor fibration in the region of super small distances was investigated. In [9] this resulted in the conclusion that in this region quantum theory is changed radically. Here are the main elements of a new quantum scheme:

α) The momentum space of new theory is the H.Bohr-compactification bM_p of the usual momentum space M_p which is now endowed by the Bohr-measure. Functions on such a space form a non-separable Hilbert space (so called almost periodical functions).

β) The configuration space M'_X connected with bM_p is a discontinuum. Functions on this discontinuum are labeled $\psi'(X)$ [3]

γ) The second quantized version of the field theory on discontinuum is (in the case of Dirac fields) connected with permutation relations $\{\psi(X), \bar{\psi}\left(X'\right)\} = 0$, which (at $X = X'$) determine a Grassmannian ring $S_8^{(*)}(G)$.

δ) It turns out that this ring is algebraically non-closed and permits the extension to an algebraically closed fundor ring $T^{\wedge}[F]$ (the tensor algebra with Cartan external multiplication $\wedge$ building over the fundor space F).

ε) With this extension the extension of the complex number ring C to the Heisenberg ring $U\left[h_8^{(*)}\right]$ is connected. A new kind of dynamical system, called bi-Hamiltonian, stands behind this ring (see [9]). **This dynamical structure is ether**.

Hereby the fundor space F is the carrier space of the Heisenberg algebra $h_8^{(*)}$ and states of the bi-Hamiltonian dynamical system. The enclosure $S_8^{(*)}(G) \to h_8^{(*)}$, i.e. $\psi_\alpha \to \Phi_\alpha$, $\bar{\psi}_\alpha \to \bar{\Phi}_\alpha$, is called quantization of the Dirac-Grassmann fiber (note that it is not a homomorphism). Φ_α, $\bar{\Phi}_\alpha$ are generators of algebra $h_8^{(*)}$. We will further speak that Φ_α, $\bar{\Phi}_\alpha$ are canonical variables of ether. They obey the permutation relations

$$\left[\Phi_\alpha, \bar{\Phi}_\beta\right] = \delta_{\alpha\beta} \quad , \qquad \left[\Phi_\alpha, \Phi_\beta\right] = \left[\bar{\Phi}_\alpha, \bar{\Phi}_\beta\right] = 0 \quad (4)$$

[3] Usually in quantum mechanics it is emphasized that particle wave function are determined only with exactness to some scalar multiple: ψ and $C\psi$ (C-constant) represent one and the same state of particle. It turns out that particle wave function includes an even higher degree of uncertainty: $\psi(X)$ and $\psi(X) + \psi'(X)$ (where $\psi'(X) = \sum_i \delta_{X,X_i}\psi'(X_i)$ is a point-like function on M'_X) represent one and the same particle state. $\psi'(X_i)$ describes point-like constituents of fundamental particle - granules [9] (note that $\psi'(X)$ is a superposition of some granules; such is impossible for particles). These are hidden entities since for the usual norm $\|\psi(X) + \psi'(X)\| = \|\psi(X)\|$. In order to open them we have to go over from the X-picture to the p-picture (momentum one) in which we have $\psi(p) + \psi'(p) = \int \psi(X) e^{ipX} dX + \sum_i \psi'(X_i) e^{ipX_i}$ (continuous and discrete spectra). Here we can use a new Bohr-norm $\|\psi(p)\|'$ with the property $\|\psi(p) + \psi'(p)\|' = \|\psi(p)\|'$, see [9]. If there is a superposition $\psi(X) = \psi_1(X) + \psi_2(X)$ so $(\psi_1(X) + \psi'(X)) + \psi_2(X) = \psi_1(X) + (\psi_2(X) + \psi'(X))$. It follows from here that $\psi'(X)$ decides selection problem and wave function reduction at measurements: probable answer lies in the particle structure (compare with von Neumann [10], Capture 6).

Discontinuum (discretized configuration space) underlies the quantization procedure of space-time. In [9] it is shown how space quantization procedure (in particular the appearance of wave properties of isolated point of discontinuum) is clinging to the matter quantization procedure.

The dynamical variables of ether are all the possible bilinear forms $\bar{\Phi}_\alpha \Phi_\beta$, $\Phi_\alpha \Phi_\beta$, $\bar{\Phi}_\alpha \bar{\Phi}_\beta$. The latter form the Lie algebra isomorphic to the Lie algebra of the automorphism group $Sp^{(*)}(4, C)$ of the algebra $h_8^{(*)}$ (dynamical group of the ether). The most important of these are the variables of 4-momentum $p_\mu = i\bar{\Phi}\gamma_\mu P_+ \Phi$, $\dot{p}_\mu = -i\bar{\Phi}\gamma_\mu P_- \Phi$ where γ_μ, $P_\pm = \frac{1}{2}(1 \pm \gamma_5)$ are Dirac matrices. p_μ do not commute with $\dot{p}_\mu$. Thus from the dynamical point of view ether is a kind of a two level system, therefore named bi-Hamiltonian [9]. States of the system f (characterized by energy-momentum p_μ) and $\dot{f}$ (characterized by $\dot{p}_\mu$) obey the equations (analog of the Schroedinger equation)

$$-i\frac{\partial}{\partial x_\mu} f(x) = p_\mu f(x), \quad -i\frac{\partial}{\partial \dot{x}_\mu} \dot{f}(\dot{x}) = \dot{p}_\mu \dot{f}(\dot{x}). \quad (5)$$

These are the main equation of ether theory.

So ether is a kind of a wave because $f(x)$ and $\dot{f}(\dot{x})$ are functions of coordinates x_μ and $\dot{x}_\mu$. However, these coordinates are not the space-time coordinates, they exist within the isolated point X_i of discontinuum (within the spinor fiber). It is very important to emphasize that these waves are not a Lagrangian field existing in the space-time continuum; they are given only on the discontinuum. It is interesting to notice that a coordinate system is connected with these fields at rest. It can be said that the wave $f(x)$ is fastened to the point X_i and surrounds it (in [9] such an object is called a spaceuscula; now we suggest to call it ether wave). In the whole (as an ensemble of isolated points X_i of discontinuum in which there is bi-Hamiltonian dynamical system) *ether is a "gas" of non-standard* (non-spatial, complex, see (4), state without ground-state, see [9]) *oscillators* hidden inside the isolated points X_i.

At strong compression of the wave $f(x)$ in the point X_i, an irreversible quantum transition $f \to \dot{f}$ takes place in the system (quantum theory of ether as a bi-Hamiltonian system is non-unitary). This transition is described by a matrix element $\left\langle \dot{f}(\dot{x}), f(x) \right\rangle$ with which the bilocal field of a Lagrangian particle $\psi(x, \dot{x}) = \psi(X, Y)$ is connected (here $X = \frac{1}{2}(x + \dot{x})$, $Y = \frac{1}{2}(x - \dot{x})$). This bilocality (consequence of the bi-Hamiltonian character of the system) solves the problem of ultraviolet divergences completely [9].

4. Conclusion

We can say that there exists a fourth level of matter description: iv) subquantum (ether wave mechanics).

Ether plays the role, first of all, of cutting edge concerning infinities in quantized field theory. Therefore the notion of ether is not to be excluded from physics. As a physical system ether has our highest interest as a new source of energy: namely energy released in the transition $f \to \dot{f}$ created our Universe supplying the first fundamental particles. Picturelly speaking, it is the supplementary energy needed for the creation of particle downpour (the experiment mentioned in the beginning) as if pressed out of space-time (indeed from the ether filling space-time).

At last it is interesting to note else that at subquantum level two physical categories - matter and space-time - become one: pre-matter or ether category (see Figure).

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ON THE UNITED NATURE OF GRAVITATIONAL, ELECTROMAGNETIC AND NUCLEAR INTERACTIONS

N.A. Zhuck[1]

Research and Technological Institute of Transcription, Translation and Replication, JSC
Box 589, 3 Kolomenskaya St., Kharkov 61166, Ukraine

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Ways of unifying physical interactions are shown. The gravitation is shown as infringement of symmetry of electrical forces. Formula of gravitational constant is deduced. Constant of nuclear interactions is found.

1. Introduction

The real potential of the gravitation of a material body is similar to the potential of nuclear forces proposed by Japanese physicist Yukawa in 1935 [5, 6, 7, 10, 11, 12, 14, 15]. Having included a certain force constant in the structure of the interactions, they both thereby propose the quantization of matter. Therein lies, apparently, one more fundamental law of the nature: these physical interactions are similar, but their exhibitions are different on various scales and with distinct densities of matter.

Moreover, there are weighty arguments that the gravitational and nuclear interactions are basically the same type of a physical interaction, whose manifestation we observe either in extremely rarefied matter (Universe), or extremely dense (atomic nucleus) matter. Thus we watch the first manifestation as if from inside and the second manifestation from outside in relation to the environment where the relevant interaction works.

2. Ways of unifying physical interactions

Assuming that the gravitational and nuclear interactions are identical, we can write by analogy with the expression for the radius of gravitational interaction

$$R_0 = c\sqrt{\frac{3}{4\pi G\rho_0}} \tag{1}$$

the expression for the radius of nuclear interaction

$$R_n = c_n\sqrt{\frac{3}{4\pi G_n\rho_n}}, \tag{2}$$

where c_n, G_n is the speed of the propagation of interations in the nuclear matter (the so called nuclear speed of "light") and the constant of the nuclear forces respectively.

Dividing expression (2) by (1), we get relationship

$$\frac{R_n}{R_0} = \frac{c_n}{c}\sqrt{\frac{G}{G_n}}\sqrt{\frac{\rho_0}{\rho_n}}. \tag{3}$$

The left-hand side of relationship (3) can be calculated; it is approximately equal to 10^{-41}. The first factor in the right-hand side can also be estimated. The ratios G/G_n and ρ_o/ρ_n in the two next factors can be evaluated, proceeding from the equality of the left-hand and right-hand sides. There can be an infinite set of solutions to the task, but we shall choose the two simplest solutions (as the nature dislike complications), which presuppose the two possible ways of unifying gravitational and nuclear interactions:

$$1)\ c_n \equiv c, \quad G_n \neq G; \tag{4}$$

$$2)\ c_n \neq c, \quad G_n \equiv G. \tag{5}$$

If we use relation (4), we obtain the relationship for the constants of interactions

$$\frac{G}{G_n} = \frac{R_n}{R_0}\frac{c^2}{c_n^2}\frac{\rho_n}{\rho_0} = \xi^2\frac{\rho_n}{\rho_0}, \tag{6}$$

where the designation $\xi = R/R_0 \approx 10^{-41}$ is introduced. If we use relation (5), we arrive at the relationship for the speeds of interactions

$$\frac{c_n^2}{c^2} = \frac{R_n}{R_0}\frac{G_n}{G}\frac{\rho_n}{\rho_0} = \xi^2\frac{\rho_n}{\rho_0}, \tag{7}$$

As is seen from expressions (6) and (7), in both cases the same relation is formed

$$\chi = \xi^2\frac{\rho_n}{\rho_0}, \tag{8}$$

[1] e-mail: zhuck@insurance.kharkov.ua

which, first, gives no grounds to prefer one option to the other and, second, to accurately determine its magnitude. The approximate value of the ratio is about 10^{-39}.

However, in the physics of atomic nucleus and elementary particles [3], there is the dimensionless relation for the intensity of gravitational interactions

$$\delta = \frac{Gm_p^2}{\hbar c}, \tag{9}$$

where m_p is the mass of the proton, which has the order of the above mentioned magnitude (8). The relation is a simplification of the more complicated expression

$$\gamma = \frac{\left(m_p^2 G\right) / \left(\hbar / m_p c\right)}{m_p c^2}, \tag{10}$$

which is called in Ref. [4] the gravitational constant in natural atomic units, whose value is known precisely enough, — $5.902 \cdot 10^{-39}$.

Having regard to the identical physical sense of all the said relations, we can set hereinafter $\chi = \delta = \gamma = 5.902 \cdot 10^{-39}$. This value demonstrates that the nuclear interaction by approximately 39 orders is stronger than the gravitational interaction. On the other hand, the interactions can be compared by the bond energy Δmc^2 as well. If we proceed from such a comparison, the given order for the ratio of the speeds of light in the atomic nucleus and the Universe is twice as little, which automatically leads to the acceptance of the second hypothesis (5). In view of this assumption, the speed of the propagation of interaction in an atomic nucleus will be equal to

$$c_n = \chi c \sqrt{\frac{G_n}{G}} \sqrt{\frac{\rho_n}{\rho_0}} = \chi c \sqrt{\frac{\rho_n}{\rho_0}}, \tag{11}$$

which, with allowance for the rough equality $R_0 \approx 10^{26}$ m, gives the magnitude about of 10^{-12} m/s.

Despite the small magnitude of the speed of "light" in the atomic nucleus, the time of the "intersection" of the proton or neutron at such a speed will be equal to 0.001 s, which is comparable with the rate of nuclear reactions. Other (larger) speeds of interaction between elementary particles can only mean that they move not through the nuclear matter, but through the interatomic environment, i.e. through the physical vacuum (ether).

One more direction to draw likely analogies. In Ref. [6] the expression for the mass of the graviton has been obtained and its magnitude has roughly been calculated. So far, gravitons have been considered as massless particles. Now that this situation has been corrected, it is possible to safely say that the interatomic environment — the physical vacuum or the aether, one can call the environment the way one likes best — is material.

At the same time, in connection with discovery of exponential law of the propagation of light and the change in the equations of electrodynamics to the form [11]

$$\Box \mathbf{E} - \frac{1}{R_0^2}\mathbf{E} = 0, \tag{12}$$

$$\Box \mathbf{H} - \frac{1}{R_0^2}\mathbf{H} = 0, \tag{13}$$

one similarly obtains the expression for the mass of rest of the photon can be obtained in a similar way

$$\mu_\nu = \frac{\hbar}{R_0 c}, \tag{14}$$

This expression shows, first, that the electromagnetic interaction takes place through material substance as well, but not through an absolute vacuum, as has been believed until recently; second, that the mass of carriers of these interactions, like in the case with the gravitational interactions, is not equal to zero; third, the masses of the graviton and the photon are equal.

The above gives rise to a very interesting idea: what if there is no need to search for gravitational waves? Perhaps, we have already being using them for a long time, by switching on and listening to a radio receiver, watching TV set, etc... One more fact point to it as well: the constant, i.e. the maximum speed of propagation of electromagnetic interactions (the speed of light), enters into the equations of the gravitational field.

3. Gravitation as infringement the symmetry of electric forces

At the turn of the 19th and 20th centuries, Dutch physicist H. Lorentz, came up with a hypothesis that the gravitational interactions could be the result of an uncompensation of forces of the electric attraction between the unlike charges and electric repulsion between the like charges in the electrically neutral Universe. Actually, he doubted the symmetry of Coulomb's law for attractive and repulsive forces. However, he did not show how this idea could possibly be implemented.

Lorentz devoted the main part of his scientific work to the study of electromagnetic phenomena. He was not engaged in researching the theory of gravity. Hence his hypothesis was probably a casual conjecture, which he did not develop later.

By virtue of "electric" specificity of his study, Lorentz reasoned in the following way. Any macroscopic body as a whole is electrically neutral as contains equal numbers of negative and positive charges. Under Coulomb's law, each charge interacts with all the other charges; it is attracted to charges of the opposite sign and is repulsed from the like charges. If one summarizes all

those forces by all the particles, the total force of interaction between the bodies should apparently be equal to zero.

The Lorentz's idea reduced to that that if the attractive force between two like charges even slightly exceeded a repulsive force between charges of the same sign, the force of interaction of two macroscopic bodies would appear small but still a finite magnitude. Abundantly clearly that the residual force should be directly proportional to the number of charges contained in those bodies (i.e. their masses), and inversely proportional to the square distance between them as in the Coulomb's law.

Lorentz stopped at this point. However Russian scientist Kaleganov [2] has recently found the reason for the asymmetry of forces: each elementary charge is attracted to all charges of the opposite sign and is repulsed from all identical charges minus one charge (it is not repulsed from itself!). Based of the identity of gravitational and electrical forces, he derived the generalized formula for the gravitational constant, which included a certain unknown number of charges of the Universe.

With the first assumptions about the finiteness of the Universe and its size (i.e. the amount of charges), the magnitude approximately equal to the gravitational constant was gained. At the same time, there is an objection as the finiteness of the Universe should obviously result in the anisotropy of its properties in the middle and at the peripherals; but such a difference has not been revealed. However, if the Yukawa potential describes the real gravitational interaction, the problem is eliminated. Nevertheless, let us first follow Kaleganov's reasoning.

Coulomb's law for charges q_1 and q_2 which are r apart

$$F_q = \pm k_0 \frac{q_1 q_2}{r^2}, \tag{15}$$

includes the empiric coefficient $k_0 = 8.9875 \cdot 10^9\ N \cdot m^2/c^2$, (note that the universal gravitational law also contains a similar constant); its value is defined by the dielectric constant ε_0 ($k_0 = 1/4\pi\varepsilon_0$). Lorentz's hypothesis can be treated as a conjecture that the coefficient k_0 in Coulomb's law has different values, depending on whether particles are attracted or repulsed. In other words, in the case of attraction one should use the coefficient k_+ and in the case of repulsion the coefficient k_-, with the small relative discrepancy between k_+ and k_- being equal about 10^{-40}. Then the difference between the electric attractive and repulsive forces will represent the effect, which might be interpreted as the gravitation. The magnitude 10^{-40} is smaller than the relative precision of measuring the value k_0 by many orders. Consequently, at the modern level of advanced engineering Lorentz's hypothesis can be neither proved nor denied.

Certainly, admitting Lorentz's hypothesis, Kaleganov replaced one riddle of the nature with the other. That is, in what way, can one explain, according to Lorentz's hypothesis, the discrepancy between the magnitudes of the empiric coefficients k_+ and k_-?

Kaleganov proposed to do the following. According to the contemporary views, our Universe contains a final number of elementary particles, which is estimated by the magnitude $N = 10^{86}$. Thus the Universe as a whole is electrically neutral, as charged particles (for example, electrons and positrons) are created and annihilated only by pairs.

Each elementary charge of the Universe is attracted to $N/2$ charges of the opposite sign, but is repulsed only from $N/2-1$ charges. Therefore, in the finite Universe, some asymmetry between the electric attraction and repulsion should exist and the universal gravitational force just expresses such an asymmetry.

Kaleganov expressed these reasons by the way of special dependences of the coefficients k_+ and k_- on the number N:

$$k_+ = k_0\left(1+\sqrt{\frac{2}{N}}\right), \quad k_- = k_0\left(1-\sqrt{\frac{2}{N}}\right). \tag{16}$$

According to these formulas, with $N \to \infty$, there are tendencies $k_+ \to k_0$ and $k_- \to k_0$, but at any finite N the inequality $k_+ > k_-$ still holds, so that

$$k_+ - k_- = 2k_0\sqrt{\frac{2}{N}}. \tag{17}$$

Then he derived the formula for the gravitational constant G and calculated its value, considering that each of two electrically neutral bodies were spaced at r and included n elementary charges e each. According to Newton's universal gravitational law, for two masses m_1 and m_2

$$F_N = G\frac{m_1 m_2}{r^2}, \tag{18}$$

The force of interaction of charged particles

$$F_n = G\frac{n^2 m^2}{r^2}, \tag{19}$$

where m is the mass each charge. Then, according to Coulomb's law, which is revised in conformity with Lorentz's hypothesis, the force of interaction of charges becomes

$$F_{nq} = \frac{k_+ - k_-}{2} \cdot \frac{n^2 e^2}{r^2}. \tag{20}$$

This implies that

$$G = k_0\sqrt{\frac{2}{N}}\frac{e^2}{m^2}. \tag{21}$$

Having assumed that elementary electric charges are electrons and positrons, Kaleganov obtained $G = 4 \cdot 10^{-11}\ H \cdot m^2/kg^2$, which is very close to the experimentally measured value of this magnitude.

The theory of gravity, based on Lorentz's hypothesis, possesses a great heuristic value, as it explains Newton's gravitation law and makes it possible to calculate the value of G, which is known from the experiment. Therefore, there is no need to consider the gravitation as an absolutely special type of the interaction.

Despite attractiveness of Kaleganov's ideas, the problem of determining the magnitude G still remains. First, edges of the Universe were not revealed, i.e. there are no arguments, which point to the finiteness of the number of particles in the Universe. Second, if the Universe were finitesimal, this would definitely result in the anisotropy of its properties in the middle and on its peripherals, but such an anisotropy was not revealed yet. Third, at present there is every reason to believe that the Universe is flat, homogeneous and isotropic and that each particle of the Universe interacts with other masses, according to the Yukawa potential, i.e. virtually within the limits of a range called the radius of gravitational interaction.

The last circumstance eliminates the said alternative, i.e. the calculation of the gravitational constant. However, it gives other opportunity, which makes it possible both to calculate the gravitational constant and to determinate an analytical formula for it.

4. Deduction of formula for gravitational constant

As the study has shown, the real gravitational law has the form

$$F = G\frac{m_1 m_2}{r^2} e^{-\frac{r}{R_0}} \left(1 + \frac{r}{R_0}\right), \tag{22}$$

in which the radius of gravitational interaction is defined by expression

$$R_0 = c\sqrt{\frac{3}{4\pi G \rho_0}}. \tag{23}$$

The said radius is approximately equal to 10^{26} and although it is a limited magnitude, any material body, according to expression (22), interacts with other bodies in remote parts of the Universe up to infinity. Then the procedure for deriving N becomes unclear. Of course, one can use the linear approximation of law (22)

$$F \approx G\frac{m_1 m_2}{r^2}\left(1 - \frac{r^2}{R_0^2}\right) \tag{24}$$

and calculate the number N of material particles in the sphere of the radius R_0. However, expression (24) noticeably differs from both the formula of the substantial law of gravitation (22) and the formula of Newton's gravitational law (18). Therefore, it is not known how one can compare it with the formula of Coulomb's law. Here it is necessary to make two relevant observations.

First, Coulomb's law, like Newton's gravitational law (18), should be replaced with generalized Coulomb's law when one passes to the cosmological scale

$$F_q = \pm k_0 \frac{q_1 q_2}{r^2} e^{-\frac{r}{R_0}} \left(1 + \frac{r}{R_0}\right). \tag{25}$$

Indeed there are grounds in modern cosmology for such a replacement. The point is that modern cosmology is based not only on the theory of gravity, but also on the theory of electromagnetism, whose equations should be modified in connection with the finding of the law of the exponential decrease in the frequency of light [8, 9, 13, 16] when it spreads at huge distances. Accordingly, expression (25) is obtained when one passes to separate charges. After that the formulas for both the universal gravitational law and generalized Coulomb's law again become similar to each other, like in classical physics.

Second, formulas (22) and (25) are characterized by a very relevant property. As it was shown in Refs. [11, 12], from the energetic point of view the gravitation law (22), which is true for the real Universe, can be replaced with Newton's gravitational law, if the radius of the action of gravitational forces is restricted by magnitude R_0 in relation to function

$$F_1 = \begin{cases} G\frac{m_1 m_2}{r^2} \text{ if } r \le R_0, \\ 0 \text{ if } r > R_0. \end{cases} \tag{26}$$

This property has made it possible to resolve a series of challenging problems, in particular, to demonstrate the identity of the inert and the gravitational masses. However, in our case it has a separate meaning. That is, the interaction on the infinite scale, which is estimated by expression (22) is equivalent to the interaction within the range of the radius R_0, which is calculated by expressions (15) and (18). This is justified by using the method of determining the number of particles N only in the sphere of the radius R_0. Indeed, the interaction among with the infinite number of particles (22) and (25) is equivalent to interaction with N particles (15) and (18).

We shall use expressions (15) and (18) to determine the equivalence between the electric and gravitational interactions, and take into account the number of interacting particles in the sphere of the radius R_0 with the density of particles ρ_0. In this case, contrary to Kaleganov's case, we treat, instead of separate electrons and positrons, particles with the mass m, which include electrons (with the mass m_e), protons (with the mass m_p) and k_n neutrons (with the mass m_n): $m = (m_e + m_p + k_n m_n)/2$. In doing so, we consider interactions in the matter, which mostly take place between the first two particles, with the third particle

being neutral (it does not interact at large distances), influences the total number of the first two particles in the total mass of matter of the Universe.

Then the number of interacting particles will be equal to

$$N = \frac{4\pi R_0^3 \rho_0}{3m} = \frac{4\pi R_0^3 \rho_0}{3m} \cdot \frac{Gc^2}{Gc^2} = \\ = \frac{1}{R_0^2} \cdot \frac{c^2 R_0^3}{Gm} = \frac{c^2 R_0}{Gm}. \quad (27)$$

Substituting expression (21) and taking into account that the electric interactions take place between electrons and protons, we obtain the expression for the gravitational constant

$$G = k_0^2 \frac{2m}{{}^2 R_0} \frac{e^4}{m_e^2 m_p^2}. \quad (28)$$

If we substitute $k_n = 2...7$ and $R_0 = 10^{26}$, we obtain the right order of the magnitude G , which points to the fact that the gravitation can indeed result from breaking the symmetry of the electric attractive and repulsive forces by the method stated above.

It is necessary to note that according to expression (27), the radius R_0 depends on the inverse proportion on the number N. Thus, the decrease in number of interacting particles will reduce the radius of the gravitational interaction. This circumstance will be used for the following analysis.

5. Determination of constant of nuclear interactions

We can assume that on the outskirts of the Universe with the even average distribution of the matter there is an island in which interacting particles (electrons and positrons) are arranged in a much close way so that the interaction with particles which are far from the island can be neglected. Then, in expression (21), we should include not the total number of particles of the Universe, which interact with a particular particle, but the number of particles of the island with the great density of the matter. This idea comes to mind when one applies the above-mentioned approach to an atomic nucleus. Let us now look at modern views on the structure of protons and neutrons.

Ukrainian physical chemist B. V. Bolotov, along with his wife and son, have elaborated a new table of chemical elements called the isosteres [1]. The common crisis in physics of nuclear particles became a basis for the creation of the given table. Science has accumulated a wealth of experience in the study of chemical reactions. The techniques of experiment have become more expanded and as a result, the newest data about chemical elements and their compounds, which not always correspond Mendeleyev's table, have appeared.

The table of isosteres has been elaborated on the basis of long studies of inorganic compounds obtained due to chemical reactions at energies from units of eV up to units of MeV. Considering the structures of isotopes and isobars in the framework of isosteres, the authors have offered a new theory of the constitution of matter, which differs from the planetary model of the Bohr atom.

Allowing for the deficiencies of Mendeleyev's table, the authors propose their own hypothetical pattern of the world, using for this purpose the Universe composed of two spaces:

1. A space having the property of the linear expansion along three coordinates.

2. A space having the property of the time expansion also along three coordinates.

Representing the pattern of the world as consistent with the two spaces, the authors propose their own model of an elementary particle of the atom, assuming that the particle is an antinode of actual vibrating elements of the substance, which can exist in one space during the half-period and in the other space during the second half-period. The particle, which can be imagined as the spherical surface and which is contracting to the point and which exists during the first half-period, has been symbolically called the electron. The electron, which is compressed exactly to the point and which exists in the second half-period, has been called a pi-electron, or positron. Thus, the full period of proper oscillations of the electron and the pi-electron represents a pair of the electronic and pi-electronic resonators. Such a pair is hence a brick for all nuclear particles and atoms. The construct ion, which has been proposed on the basis of Platonic Solids, produces the universalization of the entire nature of nuclear particles and atoms. Some preference is given to hydrogen atoms, which do not differ from nuclear particles by their constitution and replicate nine textures similar to five Platonic Solids and four bodies which do not inhere to Platon.

According to the physicochemical table of isosteres, the number of atoms in the Nature exceeds ten thousands and 105 members of Mendeleyev's table are a partial case of the table of isosteres. Isosteres, as well as known atoms, are characterized by absorption frequencies. The authors suggest that the absorption frequencies are linked to the mass of the electron, which differs from the mass of the electron in a vacuum and is often smaller. The members of the table of isosteres, which is constructed from the table of magic numbers, are located along the cylinder helix line. In the table, each member is provided by the known parameters and new characteristics, which have been calculated by the authors.

Without going into the table of isosteres, we can use only the fact that according to the model of Bolotov's atom, the proton consists of 1862 electrons and

positrons, which are found in a bound state. Then, substituting this number in formula (21), we obtain the constant of nuclear interactions

$$G_A = 9 \cdot 10^9 \sqrt{\frac{2}{1862}} \left(1.76 \cdot 10^{11}\right) = 9.1 \cdot 10^{30}. \qquad (29)$$

If we to look at the ratio of the constants of nuclear kernel and gravitational interactions

$$\frac{G_A}{G} = \frac{9.1 \cdot 10^{30}}{6.67 \cdot 10^{-11}} = 1.36 \cdot 10^{41}, \qquad (30)$$

we will get approximately the same proportion, which is known from the experiments and other analytical investigations.

It is necessary to make an illustrative reservation here, which is associated with the appearance of two ratios of the constants of gravitational and nuclear interactions: 10^{-39} and 10^{-41}. The matter is that the forces of electric interaction between the electron and proton and between the electron and positron are equal, while the gravitational interactions between them are distinct in these two cases. It is the distinction in the masses of the proton and electron, whose ratio is equal to 1,862 (by Bolotov) that is the reason for the apparent discrepancy in the above-stated ratios of the constants of interactions. The distinction is caused only by the method of determining of the said ratio.

6. Conclusion

Thus, we have affirmed Lorentz's hypothesis and its further development by Kaleganov about the existence of a link between the gravitation and electricity, i.e. essentially that the nature of the gravitation is stipulated by breaking the symmetry between the electric repulsive and attractive forces. Moreover, the applying of the formulas to an atomic nucleus has shown that the nuclear forces can be presented in the same way. Therefore, the gravitational, nuclear, and electromagnetic forces most likely have the same nature, i.e., an electrical nature. This fact bring us closer to understanding mechanisms of how the gravitational and nuclear forces operate, but at the same time, raises the problem about the necessity of uncovering the nature of electric forces, i.e. the structure and properties of a physical vacuum (ether).

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DIFFUSION MODEL OF THE PHYSICAL VACUUM AND ITS EXPERIMENTAL CONFIRMATION

V.I. Balabay[1]

Research and Technological Institute of Transcription, Translation and Replication, JSC
Box 589, 3 Kolomenskaya St., Kharkov 61166, Ukraine

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The analysis of performances measuring methods of the perfect vacuum is given. It is shown, that the perfect vacuum has the energy performances, and its inhomogeneities represent radiants (sinks) creating temperature lapse rates and diffusion streams. Interaction of bodies in the perfect vacuum is featured by general legitimacies proper in processes in thermodynamics, electrodynamics, gas-dynamics and hydrodynamics, which feature transport phenomenas and diffusions.

1. Introduction

In the end of XX century a representation about an ether is replaced by concept of the perfect vacuum. Initial representations about the vacuum as is absolute a blank space, filled atoms, was transformed to concept of the perfect vacuum, which can cause a pair of antiparticles or two gammas of quantums formed at an annihilation of particles. The existence of this fact has given in a deduction, that it is impossible to consider Space as a blank space. It is completed with material substation, which now term as the "perfect vacuum" (further the vacuum).

2. General principles of build-up of diffusion model of a perfect vacuum

The diffusion model of a perfect vacuum streams from results of experimental investigations XIX and XX of centuries it is experiment of Bredli (1728), Fizeau (1851), Hock (1868), Sagnak (1913), Michelson-Gell (1925), Balabay (1993), from a hypothesis of Riemann "about a certain substance which continuously directs in ponderable atoms and there disappears", and representations about an ether as about physical medium combining properties as of an ideal incompressible fluid (the electromagnetic theory of an ether of Maxwell), as solid elastic body (theory of an ether of Mak Kellag, 1839, precursor of the electromagnetic theory of a light, which gives almost in the same formulas, as this last), and with physical mathematical representation as medium from noninteracting particles (physical mathematical model of Zeldovich, Myshkis, 1973), generality of processes of a diffusion in transport phenomenas for any physical mediums.

The modern representations about a perfect vacuum are founded on results of experimental investigations of the end XIX and beginning XX centuries and theoretical hypotheses on their explanation. Existing in that time among the physicists the representation about an ether as about a material medium having unique physical properties, required experimental checkout. A lot of physical experiments confirming existence of a material medium and "ether wind" was carried out. The sole experiment, experiment of Michelson has not found the theoretical explanation from scientific knowledge, available in that time, and was interpreted as experiment negating existence "ether wind", and consequently also material mediums. The attempts of its explanation by a hypothesis of Fitzgerald about cutting the sizes of a material body in a direction of its motion have not proved to be true by the further experiments, but, nevertheless, become a basis of Lorentz transformation laws for inertial reference system, for build-up of the base of a modern physics.

The experimental checkout of a hypothesis of Fitzgerald was carried out by Ivanov for air medium in system a radiant-mirror at investigation of the phenomenon of a cramping of standing waves in dynamics. Has appeared, that length of a standing wave depends on velocity and orientation of this system. Thus the cutting of a material body occurs not only in a direction of a motion, as follows from a hypothesis of Fitzgerald, but also in a transverse direction. There is a physical cutting of the sizes (cramping of gauges) propellented system. This transformation, as against Lorentz transformation laws, have received a title of physical transformations and completely have explained "zero" result of experiment of Michelson and Kennedi. "Zero" result of experiment of Michelson confirms a principle of a rel-

[1] e-mail: grav@insurance.kharkov.ua

ativity in all inertial reference system all physical phenomena flow past under the same laws. The theory and experiment specify at absence of interaction of inertial systems with a perfect vacuum. For inertial systems the perfect vacuum as physical medium absence it is "empty".

The interaction of a perfect vacuum as physical medium with material bodies occurs only at presence uniformly accelerated motions or material body concerning a perfect vacuum (inertial mass), or perfect vacuum concerning a material body (gravitational mass). Results of investigations of the indicator of a gravitational stream (Balabay, 1993) have confirmed existence of a gravitational stream and have allowed to establish that fact, that inertial and gravitational mass feature the same physical process, process of interaction of a material body with a gravitational stream.

The origin of gravitational streams in a perfect vacuum is stipulated by presence of inhomogeneities of radiants as sinks. The representation about a radiant is entered by Maxwell, the hypothesis about a radiant as a sink was expressed by Riemann. The mathematical substantiation of origin of radiants as asymptotically inconvertible points both varieties is obtained by Zeldovich and Myshkis for physical medium from noninteracting particles (physical mathematical model, 1973). The presence of radiants in a perfect vacuum (physical medium from noninteracting particles) gives in origin of transport phenomenas in sectional medium to processes of a diffusion, to origin of diffusion or gravitational streams.

The integrating of radiants gives in formation of atoms and origin in the field of radiants (atoms) of ring gravitational streams of electrons. This model considered in the theory of a fundamental field (TFF) I.L. Gerlovin (1973) also has allowed to describe and to calculate properties of electrons and other fundamental particles, to reveal unity of physical and structural properties of crystals, molecules, atoms and fundamental particles.

Radiants (sinks), group of radiants (atoms) and the material bodies consisting of atoms, create in medium (perfect vacuum) area of under pressure. As the pressure of medium is equivalent to electrical potential, that streams from model of an ether of Maxwell, and the methods of measuring of electrical potential are well investigated, the measuring of the physical performance of medium of a perfect vacuum of pressure is reduced to measuring electrical potential.

The further theoretical and experimental development of diffusion model of a perfect vacuum will allow to pass to making physics of fundamental interactions, to making on its basis of a uniform field theory.

3. Performance of a perfect vacuum and methods of their measuring

General representations about properties of gravitational medium. Gravitational medium from a point of view of usual physical representations about mediums: fluid, solid, aeriform, is ideal medium including all idealized properties of known physical mediums.

First, its it is possible to view as "absolute solid body" [12], as the perturbations in it give in origin of a transverse wave (light oscillations), that is peculiar only to solid bodies.

In second, it has properties of an ideal incompressible fluid, which properties are featured by the laws of thermodynamics. This theoretical approach has allowed Maxwell to derive the equations of an electromagnetic field and theoretically to estimate velocity of perturbations (light oscillations), incipient in such medium, which quantity subsequently was confirmed in physical experiments on definition of light velocity. Thus he radiated from the following basic guesses [13]:

"The mathematical laws of a stationary motion of heat in homogeneous mediums are identical under the shape with the laws of an attraction, being inversely proportional to a quadrate of distance. Exchanging a centre of gravity by a radiant of heat accelerating activity of an attraction by a thermal stream, potential in temperature, we converse the solution of problems on an attraction to the solution of the relevant problems on a thermal conduction;

Places, where the fluid is created, we shall term as sources, and their intensity will be defined by number of units of quantity of a fluid yielded by them in unit of time. The same places, where the fluid is erased, we shall term as sinks. Both those, and others we shall term as radiants;

In third, the particles of gravitational medium giving to it unique properties, are featured by concept of noninteracting particles with a zero rest mass which is taking place in a fixed motion [14], for which there is an interaction at collisions and which on a hypothesis of Riman [15] continuously direct in ponderable atoms and there disappear from a tangible world, or, in ponderable atoms the substance from a tangible world constantly transfers in impalpable. The reason of disappearance of a substance should be seen in immediately preceding origin in atoms of some impalpable substation, so the ponderable bodies are as though place of touch of tangible and impalpable worlds (in each powerful atom the particular quantity of a substances proportional to a gravitational force acts at each moment and there disappears). Existing... force of acceleration I try to explain by a motion of a certain substation charging all infinite space, namely, I admit, that the direction of its motion coincides with a force direction of acceleration, and the velocity it is proportional to quantity of force of

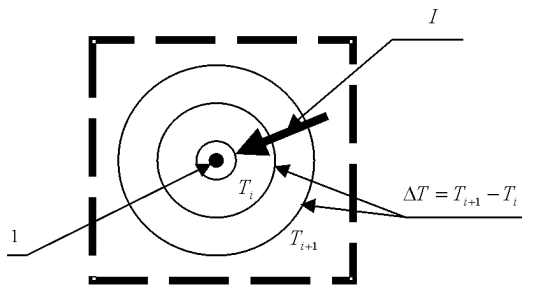

Figure 1: Structure of the vacuum inhomogeneities (1 — a sink)

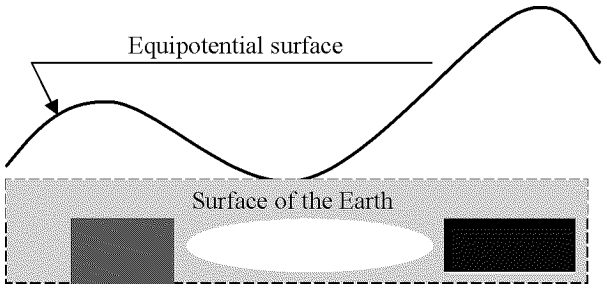

Figure 2: The plan of an equipotential surface above the ground

acceleration. This substation can be imagined as physical space, which points move in geometrical space".

In fourth, the presence of radiants (atoms, fundamental particles), creating inhomogeneity in gravitational medium, gives in origin of streams of medium, areas heightened and underdense mediums density (pressure, temperature). The streams of medium give in origin of inertial forces and gravitation, electrical and magnetic fluxes, and the area heightened and underdense mediums density are perceived by us as lapse rates of temperatures, pressures, densities, as electrical and magnetic potentials.

In fifth, temperature (density, pressure) gravitational medium defines the metric (course, current of time, regularity, extent) physical space [8].

Interrelation of physical properties of space.

In the further space we shall term a perfect vacuum including concept of gravitational medium with plurality of inhomogeneities. Inhomogeneity of a perfect vacuum we shall term as a radiant, and plurality of inhomogeneities by family of radiants. The presence of a radiant characterized by concept of intensity or temperature, creates in environmental space a lapse rate of temperatures or densities of medium. That the radiant represents a sink and creates under density of medium (Fig. 1) or the temperature difference ΔT, in space, environmental a radiant, arises process of transport of substance (energy, impulse).

Process of transport of substance [16] is characterized by a diffusion current density and is shown in ability of travel of material mass. Test of a diffusion current density is the intensity of a gravitational field g, which is equal to force, from which the stream operates on a particle with mass equal unity and located in a sectional point of space with a position vector r:

$$g(r) = \frac{F(r)}{m}, \quad F(r) = mg(r). \tag{1}$$

Mass of substance transferred at a diffusion for a time unit to the party of decrease of density (or temperature) of substance is defined by a Newton's laws featuring a transport phenomena:

$$mg(r) = G_N \frac{mM_S}{r^2}, \tag{2}$$

whence

$$g(r) = -G_N \frac{\partial T}{\partial r} = G_N \frac{T}{r^2}. \tag{3}$$

where the diffusion constant G_N is termed as the gravitational constant, and source strength M_S, creating temperature or density the inhomogeneity of medium, has received a title of mass of a material body.

Let's establish interrelation temperature and density of the performances of a perfect vacuum. Medium, environmental a radiant, we shall present as ideal gas consisting of propellented noninteracting particles, which each degree of freedom on the average has quite particular energy ε. According to the law of Maxwell for ideal gas the energy of a particle is proportional to an absolute temperature of medium, and the constant of proportionality is served a half of the Boltzmann constant, which represents quotient from division of a universal gas constant into the Avogadro number:

$$\varepsilon = \frac{k}{2}T, \tag{4}$$

where

$$k = \frac{R}{N_A} = 1,38 \times 10^{-16} \frac{erg}{grad}. \tag{5}$$

On the other hand energy of a particle represents a kinetic energy:

$$\varepsilon = \frac{mV^2}{2}, \tag{6}$$

where m "mass" of a particle, V its velocity.

As in relations (6) and (8) energies ε are the performance of the same particle, from equality of right members of these relations follows:

$$\frac{k}{2}T = \frac{mV^2}{2}, \tag{7}$$

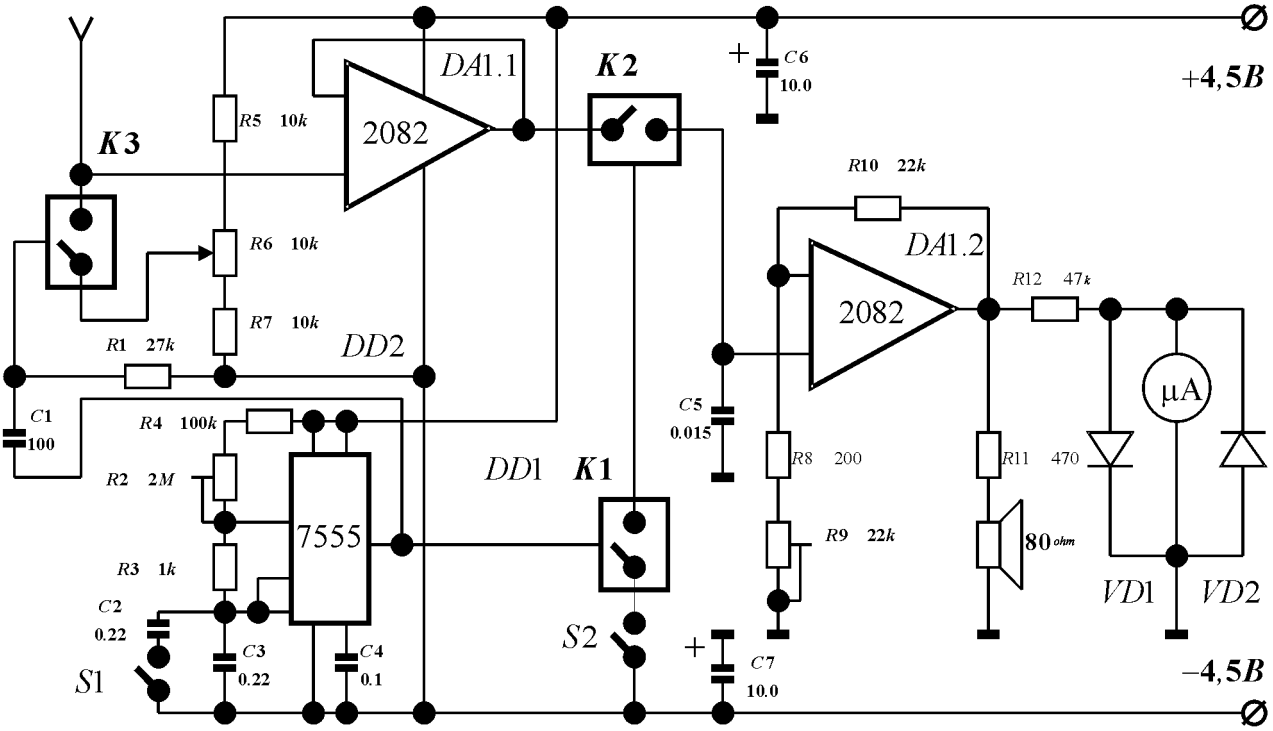

Figure 3: The scheme of an electronic biolocator

or

$$T = \frac{m}{k}V^2 = \frac{mN_A}{R}V^2. \tag{8}$$

Taking into account, that the quantity $mN_A \equiv N_A\mu \cdot 1\ a.m.u. = M$ maps mass gram-molecule, which is termed as a molecular mass M and features density the performance of medium of unit (molar) volume; μ a molecular mass of substance a dimensionless quantity equal to the relation of mass of its molecule to $\frac{1}{12}$ of mass of a stripped atom ^{12}C; $(a.m.u.)$ nuclear unity of mass equal $\frac{1}{12}$ of mass of a stripped atom ^{12}C; the mole quantity of substances containing so much of molecules, how many atoms contains in 12 g isotope of carbon ^{12}C; V^2 the quadrate of velocity of a particle of medium, appears in a role of fixed gas coefficient; R a universal or the molar gas constant, $R = 8,31441\ G/(K \cdot mole)$, we come to a deduction, that the relation (8) expresses interrelation temperature and density of the performances of medium and specifies identity temperature and density of representations.

Interrelation of physical properties of material bodies with temperature of a perfect vacuum. Radiating from the entered terminology under concept of a material body we shall understand plurality of inhomogeneities of a perfect vacuum or any family of radiants.

1. By virtue of that the radiants can have different intensity, also bodies consisting of radiants of different intensity, will have different temperature distinct from temperature of a perfect vacuum. In other words in volume of a material body under density of a perfect vacuum a lapse rate of densities or temperatures is created. The lapse rate of temperatures or densities is characterized by representations about potential and equipotential surfaces and is featured by a potential difference $\varphi(r) - \varphi(0) = \frac{\Delta T}{\varepsilon}r$, where ε the inductivity of medium, for a perfect vacuum $\varepsilon = 1$. Therefore it is possible to speak, that between any material bodies consisting of radiants of different intensity, or between a material body and perfect vacuum always there is a potential difference (gravitational or electrical) [8].

2. The change of density or temperature of a perfect vacuum calls respective alterations of temperature of a material body and all of its metric and physicochemical performances. As physical temperature is equivalent to density of a perfect vacuum, the change of all performances of a material body at temperature lapse rates will be equivalent to change of density of a perfect vacuum.

The measurement methods of the basic performances of a perfect vacuum.

3.1. Methods measuring of a density gradient of a perfect vacuum (lapse rate of gravitational temperature)

a) Method of measuring of electrical potential. Grounded on the guess that in the field of a radiant and between radiants of different intensity always there is an electrical potential difference. So for example, above a surface of the Earth representing plurality of radiants (families) of different intensity, the configuration of an equipotential surface is adequate to intensity of radiants and is schematically figured on Fig. 2.

The inhomogeneity of a potential distribution above a surface of the Earth is known from most ancient times and is applied to definition of subsoil waters, of ore and petroleum deposits with the help of a withe or so-called walking with withe. The immediate participation of the man in this process has spotted its blanket title a biodetection and ranging. The measuring of a potential difference without participation of the man is yielded by an electronic biolocator [17], which plan is shown on Fig. 3. The featured electronic device represents the sensing indicator reacting to an electric field, which can be strengthened, having spotted thus deposition of subsoil waters or presence of a latent position wiring in walls of buildings. Thus potential of an equipotential surface is measured which is acquired a telescopic antenna of the measuring device relatively "standard" potential created by the power supply. The inlet of the measuring device should ensure a small input current for elimination of influence of "standard" potential on potential created in a telescopic antenna.

The device manufactured on the basis of two operational amplifiers and three electronic keys with feed from a two-polar radiant. To an output of the first amplifier, which is included as a long-persistence repeater of a voltage with a high input resistance, the telescopic antenna is connected. Its potential concerning ground depends on parameters of an electric field. The positive and negative charges caught by antennas change a voltage on an exit of the first amplifier, which through a key $K1$ acts on an inlet of the second amplifier with an opportunity of regulation of an amplification constant.

Other two keys $K2$ and $K3$ operate in a step with frequency, which is worked out by the multivibrator on the integrated timer $DA2$. The key $K3$, connected to the antenna, is interlinked to a potentiometer $R6$, thus the voltage on the condenser $C3$ and driving deduction of a key is approximately equal to the algebraic total from the antenna of a voltage and what is set by a potentiometer $R6$. On the other hand, the responsivity of the first amplifier concerning the antenna depends on frequency, from which capacity $C2$ is discharged through a key $K3$.

The frequency of the multivibrator can be changed by a potentiometer $R1$ and switch $S2$, regulating thus in major limits responsivity of the device. General responsivity of an electronic biolocator rises and at the made standing of the switch $S2$.

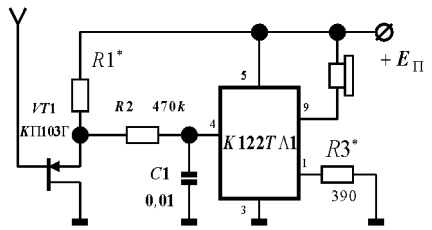

Figure 4: The electric fields indicator scheme

Instead of the amplifiers, designated on the plan, $DA1.1$ and $DA1.2$ it is possible to use any operational amplifiers with a small input current. From domestic chips the operational amplifiers $K140YD8$, $K140YD13$, $K140YD18$, $K140YD22$, $K544YD1$ will approach. The double-channel operational amplifier such as $K574YD2A, B$ is most convenient in this plan. However at replacement of amplifiers it is necessary to apply the relevant chains of correction, and also to change feed of the plan.

The integrated plan $DD1$ (4066) contains four analog switches three from which are used in the plan. From domestic chips for replacement bidirectional switches such as $KP1561KT3$ most approach. Instead of the integrated timer $DD2$ (7555) it is possible to use domestic analog $K1006BI1$. The measuring head is calculated for a current $50 - 500mA$. Diodes $VD1$, $VD2$ anyone germanium.

The simple indicator of stationary values and variable electric fields [18] can be assembled with use as a voltage divider, adjustable by an exterior electric field, of the resistor $R1$ and channel of a field-effect transistor, Fig. 4.

As the controllable generator of impulses the generator on a chip $K122TL1$ is used. The high-ohmic head sets such as $TON - 1$ $(TON - 2)$ are included in a loading of the generator for indication. At presence of an exterior fixed or variable electric field the signal directed on the antenna, acts on a driving electrode of a field-effect transistor (shutter), that calls modulation of resistance of the channel of a field-effect transistor. In a result the voltage drop on a voltage divider varies, that in turn calls occurrence of oscillation with varying frequency (occurrence of a package of impulses).

For realization of "precision" measurings of a lapse rate of gravitational temperature it is necessary to fix "standard" potential to eliminate influence of temperature instability of a material body and to supply temperature stability of a radiant.

b) Method of measuring of a magnetic conductivity. For measuring gravitational temperature all material bodies are suitable, which physical properties (for example, dielectric and magnetic conductivity) sharply react to a

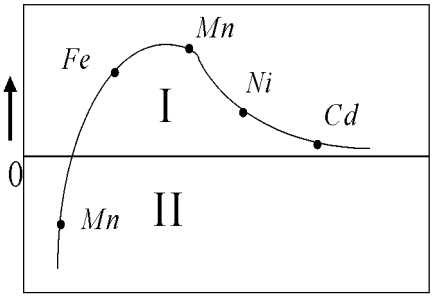

Figure 5: Exchange energy in ferromagnetics

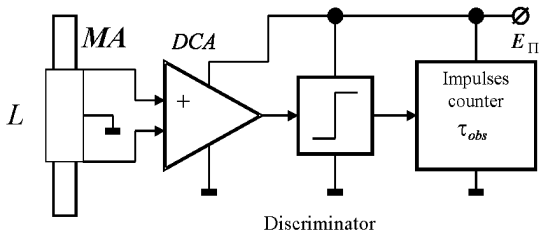

Figure 6: The scheme of the medium density indicator

temperature lapse rate and with which the "high temperature responsivity" is proper. To materials having very high value of a magnetic conductivity and high responsivity to temperature changes, the ferromagnetic materials fall [19].

The ferromagnetism is bound to crystalline structure of substance. Between electrons of the next atoms of a chip there is an exchange interaction aspiring to orient spins of their electrons parallelly or antiparallel each other, depending on the relation of a stationary value of a crystalline lattice to a diameter of an orbit of a viewed electron. At positive values of exchange forces (I), Fig. 5, not compensate spins of electrons of the next atoms are oriented in one direction, therefore the substance becomes a ferromagnetic, at negative values of these forces (II) the spins of electrons are oriented antiparallelly each other and such substances are antiferromagnetic.

The change of gravitational temperature (density of medium) should give in change of a level of an exchange interaction and, as a consequence, to change of quantity of a magnetic conductivity.

This effect is implemented by the device, Fig. 6, representing a radio receiver of direct amplification in a frequency band from $5kH$ up to $80kH$ [20].

In this device the indicator reacting to change of density of medium, is the ferrite antenna, which transfer ratio, and, hence, and responsivity of the receiver, are defined in density of medium (perfect vacuum). From an effective magnetic conductivity of the core of a magnetic antenna [21] its effective height determined by the formula

$$h_{MA} = \frac{2\pi S}{\lambda}\mu_{eff}\omega, \tag{9}$$

where S a sectional area of the core, m^2; λ a wave length, m; ω number of coils by the antenna of the reel.

The change of effective height of a magnetic antenna is arrested on change of average casual amplitude of exterior electromagnetic fields. A composition of the device enter: a magnetic antenna MA with a coupling coil L, direct-current amplifier DCA, discriminator, pulse counting device. The change of a level of electromagnetic fields is arrested by a magnetic antenna MA, amplifies by a direct-current amplifier DCA and gives in change of quantity of impulses on an exit of the discriminator totalled by a pulse counting device for fixed time of observation τ_{obs}. This device allows to yield searching for of geopathogen bands.

For holding "precision" measurings it is necessary to pass from measurings casual average changes of exterior electromagnetic fields to measuring naturally magnetic conductivities of a magnetic antenna by shaping a stable level of an electromagnetic field and security of a heatset of all device.

3.2. Measuring a gravitational stream

a) Direct methods of measuring of a gravitational stream. The methods of immediate measuring of slope of material bodies above a surface of the Earth concern to direct methods of measuring of a gravitational stream and are termed as gravimetric methods. The methods of measuring of a weight of bodies concern to indirect methods.

b) The quartz indicator of a gravitational stream [3]. The method grounded on the guess of equivalence of optical properties of a gravitational stream with a light stream. Radiating from this guess there should be physical bodies having property of optical lenses. As lenses, agglomerating and scattering a stream, the crystalline bodies chips can be applied: the homogeneous anisotropic bodies, in which radiants are located in space by the correctly constructed chains, flat grids and three-dimensional lattices. For checkout of this guess the experimental plant was created, the data unit of a stream in which is served a plate of a piezo-crystal being a basic element of the basic generator, released by an industry, "Giatsint-M". The plan of plate is shown on Fig. 7.

In its composition is entered two products "Giatsint -M", formative oscillations of frequency $5MH$ with high stability and indicator (oscillograph) fixing

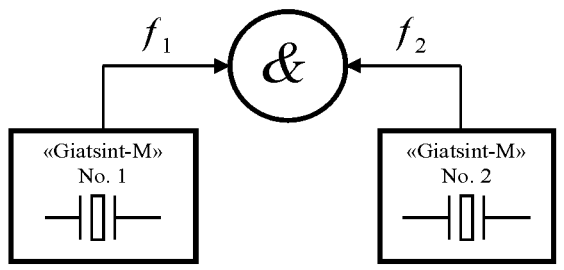

Figure 7: The bridge definition scheme of electromagnetic parameters

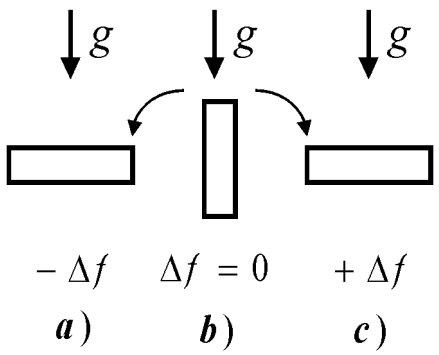

Figure 8: Versions of experiment realization (g is acceleration due to gravity)

a current difference in phase of these oscillations on a method of interference figures [22].

Before holding of experiment for realization of a requirement $\Delta f = f_1 - f_2 = 0$ smoothing current oscillation phases was yielded.

At holding experiment one of the first "Giatsint" (No 1) appeared in a role standard - with the standing, fixed in space. The second "Giatsint" (No 2) was by relative frame and supposed any travel in space. The results of experiment have confirmed, that the quartz plate which is included in a composition of the basic the first generator, answering for shaping of an oscillation frequency, reacts to a gravitational stream and really is the indicator.

On Fig. 6 the change of an oscillation frequency Δf of the basic generator (No 2) from a standing of its quartz plate in space is shown.

Before the beginning of experiment, at a vertical run of a quartz plate (disk), Fig. 8b, the frequencies of basic generators are levelled ($\Delta f = 0$). At gyration of a quartz plate against hour (Fig. 8a) and on hour (Fig. 8b) arrow was observed change of an oscillation frequency of the basic generator (No 2). It is possible to explain change of frequency by optical properties of a quartz disk for a gravitational stream. In this case it fulfills a role of a lens, focalizing or scattering a stream, that gives in magnification or diminution of density of medium in its volume and, as a corollary, — to magnification or diminution of a resonant frequency. In a design of the basic generator the elimination of exterior mechanical, temperature and electromagnetic actions is stipulated, that ensures reliability of the obtained experimental results.

The uniformly accelerated motion of the vertically located quartz plate in a horizontal direction also gives in change of frequency of the basic generator, that speaks about a uniform physical nature of streams created by a gravitational field of the Earth and as a result of a uniformly accelerated motion of bodies, about a uniform nature of "inertial" and "gravitational" masses.

4. Conclusion

Representation of a perfect vacuum as gravitational medium possessing the energy performances, and the analysis of practical methods of their measuring unclose-es a trajectory to making the new base of theoretical and experimental gravitational physics.

5. Appendix

Gravitational potential is characterized by a lapse rate of temperatures or densities of gravitational medium, features the volumetric performance of medium [8]. Than above source strength, the above its gravitational potential. As gravitational potential is exhibited as temperature, for exposition of its properties the laws of thermodynamics are valid.

Gravitational stream is speeded up directional motion of noninteracting particles caused by inhomogeneity of a perfect vacuum. Physical developments - inertia of material bodies, force of gravity [6].

Gravitational temperature is physical performance of inhomogeneity of a perfect vacuum. Physical developments:

— for the uniformly speeded up motion of atom (radiant), as was shown in 1976 by the Canadian physicist of Unru [7], its excitation is characteristic, and the allocation on levels as a result of excitation appears thermal and is characterized in temperature

$$T_a = \frac{ha}{2pk_B c},$$

where a is acceleration of a motion of atom concerning an inertial system of readout; k_B is the Boltzmann constant.

This temperature has received a title of temperature of Unru;

— in 1974 the English physicist of Hoking has shown, that the vacuum in a gravitational field of a black hole is labile. Birth of particles in such the field

gives in occurrence of a radiation flow from a black hole. Thus a spectrum and other performances of this radiation have a thermal view. Temperature of radiation measured by the observer, taking place far from a black hole, is equal

$$T_X = \frac{hx}{2\pi k_B c}.$$

Parameter x, having dimensionality of acceleration and termed by surface gravitation of a black hole, is bound to mass M of a black hole by a relation $x = \frac{GM}{R_g^2} = \frac{c^4}{4GM}$. Quantity $R_g = \frac{2GM}{c^2}$, termed in gravitational radius, defines the size of a black hole). Converts on itself attention as fact of occurrence of temperature, and that this temperature formally coincides with temperature of Unru for quantity of acceleration $a = x$;

— allocation of gravitational temperature T_f in the field of a material body

$$T_f = \ell^{-\frac{G}{r}}$$

is obtained [8] from the Newton gravitation law

$$F = \frac{GMm_0}{r^2},$$

where $F = m_0 g$ is force effective on a material body m_0 in a gravitational field of the Earth, creating a gravitational stream g; M is mass of the Earth, represents gravitational temperature T_f, and free fall acceleration; $g = \frac{dT_\Phi}{dr}$ is gravitational stream caused by a lapse rate of temperatures.

Source strength is entered by the Maxwell [9], characterizes quantity of inhomogeneity of a perfect vacuum. The physical axiomatics differs by variety of physical representations as temperature, potential, pressure, density, mass. In a broad sense term of a source strength usables both to separate inhomogeneities of a perfect vacuum and to plurality of inhomogeneities.

Material medium is the brightly expressed inhomogeneities of a perfect vacuum (atoms, fundamental particles and other formations), representing asymptotically inconvertible (attractive) stationary points and attractive varieties [1]. On a hypothesis of the Riemann [4] "the space is charged with a certain substance, which continuously directs in ponderable atoms and there disappears from a tangible world."

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POLARIZATION MODEL OF HYDROGEN ATOM

V.Ph. Tihonov[1]

Kharkiv Institute of Social Progress, Kharkiv, Ukraine

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Model of hydrogen atom, in which the proton has the terminating geometrical sizes and consists of system of charges polarized at a Coulomb interaction of a proton with an electron is considered. It is proved that the interaction energy ensuring evaluation of a radiation spectrum of hydrogen atom with enough by a high degree of accuracy is featured by a continuous oscillating curve.

The present work is one of the first stages of transition from mathematical modeling of hydrogen atom [1] to making physical polarization model of hydrogen atom.

The inconvertible state of hydrogen atom is carried out with the help of an electromagnetic interaction positively charged atomic nucleus (proton) and subzeroly charged electron.

The investigation of a dispersion of electrons and - γ quantum on a proton have allowed to find out a spatial distribution of a charge and electrical polarizability of a proton (American physicist P. Hofstedter etc., 1957; V. I. Gol'dansky etc., 1960). Really proton can be presented obviously, as a system consisting "naked" dot solid component, circled by clouds of mesons with radius up to $1,4 \cdot 10^{-15}$ m and a cloud of electron - positron pairs with radius up to $3,9 \cdot 10^{-13}$ m. [2-5].

Let's considering a first approximation one-dimensional model of hydrogen atom: the proton consists of a redundant positive point charge (positron) and positron positive and negative charges equaled to an absolute value with their linear allocation. The proton interacts with dot, negative unit charge (electron) situated beyond the proton.

As a result of this interaction there is a redistribution of a proton charge, owing to what there is a polarizability of a proton the more the closer there is an electron to a proton.

Let's present a charge line density τ of a polarized proton as:

$$\tau(r,z) = A(r) \cdot cos\left(2 \cdot \pi \cdot \frac{z}{d} + \alpha(r)\right), \tag{1}$$

$$A(r) \geq 0,$$

$$-\frac{d}{2} \leq z \leq \frac{d}{2},$$

where r is distance between a positron and electron (positron and origin of coordinates are disposed at centre of a proton);

d is linear size of a proton;

z, $\alpha(r)$, $A(r)$ accordingly current coordinate, initial phase and the amplitude of a charge distribution (is obvious, that $A(r) \to 0$ at $r \to \infty$).

On definition the quantity of a charge Q is equal

$$Q(r) = \int_{-\frac{d}{2}}^{\frac{d}{2}} \tau(r,z)\, dz, \tag{2}$$

from (1) and (2) the relations follow:

$$Q(r) = 0, \tag{3}$$

$$Q(r) = Q_1(r) + Q_2(r), \tag{4}$$

where

$$Q_1(r) = \int_{-\frac{d}{4}}^{\frac{d}{4}} \tau(r,z)\, dz, \tag{5}$$

$$Q_2(r) = \int_{-\frac{d}{2}}^{-\frac{d}{4}} \tau(r,z)\, dz + \int_{\frac{d}{4}}^{\frac{d}{2}} \tau(r,z)\, dz, \tag{6}$$

As you can see from (3) and (4), the basic property of a proton model charge ($|Q_1(r)| = |Q_2(r)|$) is fulfilled irrespectively of distance r between an electron and proton.

The energy of a coulomb interaction W of an electron with charges of a proton is equal:

$$W(r) = W\tau(r) + Wq(r), \tag{7}$$

where

$$Wq(r) = -\frac{q^2}{4 \cdot \pi \cdot \varepsilon_0 \cdot r}, \tag{8}$$

$$W\tau(r) = -\frac{q}{4\cdot\pi\cdot\varepsilon_0\cdot r}\cdot\int\limits_{-\frac{d}{2}}^{\frac{d}{2}}\frac{\tau(r,z)\,dz}{r-z}, \qquad (9)$$

here: $Wq(r)$ is electrostatic energy between an electron and positron (between an electron and proton in the conventional model of hydrogen atom); $W\tau(r)$ is electrostatic energy of an electron with a linearly distributed charge of a proton; q - absolute value of a charge of an electron (positron).

Let's introduce dimensionless quantities of distance x and current coordinate l by means of replacement:

$$r = x\cdot d, z = l\cdot d, \qquad (10)$$

Then from (5) follows

$$Q_1(x) = \frac{A(x)\cdot d\cdot cos(\alpha(x))}{\pi}, \qquad (11)$$

on the other hand to present expression $Q_1(x)$ In such view

$$Q_1(x) = \eta\cdot f(x)\cdot cos(\alpha(x))\cdot q, \qquad (12)$$

where η is constant of proportionality;

$f(x)$ is unknown function depending from x.

From (11) and (12) is discovered $A(x)$

$$A(x) = \frac{\eta\cdot\pi\cdot q\cdot f(x)}{d}, \qquad (13)$$

Using (7) - (10), and (13), after integration (9), shall receive relation for electrostatic energy $W(x)$ (expressed in eV) as

$$W(x) = \frac{q}{4\cdot\pi\cdot\varepsilon_0\cdot d}\times$$

$$\times\left\{\eta\cdot\pi\cdot f(x)\cdot[\sin(\beta)\cdot(Si(\gamma_2)-Si(\gamma_1))\right.$$

$$\left.+\cos(\beta)\cdot(Ci(\gamma_2)-Ci(\gamma_1))]-\frac{1}{x}\right\}, \qquad (14)$$

where $Si(\gamma_j)$, $Ci(\gamma_j)$, $(j=1,2)$ - accordingly integral sine and cosine;

$$\beta = 2\cdot\pi\cdot x+\alpha(x),$$

$$\gamma_1 = \pi\cdot(2\cdot x+1),$$

$$\gamma_2 = \pi\cdot(2\cdot x-1).$$

At the first stage of embodying of atom hydrogen polarization model we shall present unknowns functions $\alpha(x)$ and $f(x)$ by relations:

$$\alpha(x) = p_1\cdot x^{p_2}+p_3,$$

$$f(x) = \frac{1+p_4\cdot x^{p_5}+p_6\cdot x^{p_7}}{1+p_8\cdot x^{p_9}+p_{10}\cdot x^{p_{11}}},$$

where p_i, (i=1,2,,11) - devices of a vector p of unknowns of parameters of model.

From a requirement of an extreme of function $W(x)$ $\left(\frac{dW(x)}{dx}=0\right)$ is discovered those values x_j, which correspond to the underload quantities of an electrostatic energy $(W_j(x))\,min$, defining stable state of hydrogen atom.

The transitions of hydrogen atom from one stable state j in another - k, accompanying by radiation of photon, create a spectrum of radiation described in lengths of waves $\lambda_{j,k}$ of spectral lines (j,k is integers, $j>k$).

As the energy of a photon is equal $\frac{h\cdot c}{\lambda}$, the spectrum is defined by the formula

$$\frac{h\cdot c}{\lambda_{j,k}} = W(x_j)-W(x_k), \qquad (15)$$

where h is Planck constant;

c is velocity of light in vacuum;

$\lambda_{j,k}$ is wave length of light of the relevant series: $k=1$ is series of Lajman; $k=2$ is series of Bal'mer; $k=3$ is series of Pashen etc.

Quantity d of the linear size of a proton is discovered from a requirement $W(x_1)=-E_0$, where E_0 is ionization energy of hydrogen atom.

The fundamental stationary values (q,h,c,ε_0), value E_0 and experimental quantities $\lambda_{0j,k}$ of wavelengths of a radiation spectrum of hydrogen atom are taken from [6].

Relative diversion $\delta\lambda_{j,k}$ of design values $\lambda_{j,k}$ from experimental $\lambda_{0j,k}$ is computed under the formula $\delta\lambda_{j,k} = \frac{\lambda_{j,k}-\lambda_{0j,k}}{\lambda_{0j,k}}\cdot 100\%$.

Using analytical, pictorial opportunities and the numerical opportunities of a mathematical package MatLab optimization functions, are obtained the following results.

The parameters of model a vector device value p have made:

$p_1 = 2,232\cdot 10^{-1}$, $p_2 = 5,717\cdot 10^{-1}$,
$p_3 = 5,176$, $p_4 = -9,607\cdot 10^{-1}$,
$p_5 = 2,72\cdot 10^{-1}$, $p_6 = 2,078\cdot 10^{-1}$,
$p_7 = 5,539\cdot 10^{-1}$, $p_8 = 2,762\cdot 10^{-5}$,
$p_9 = 7,717\cdot 10^{-1}$, $p_{10} = 9,649\cdot 10^{-10}$,
$p_{11} = 1,84$.

Thus: $\eta = 415$, $d = 7,32\cdot 10^{-13}$ m.

The design values of spectral lines are submitted in the table. As you can see, the experimental and settlement spectrums of a series of Lajman practically coincide for elimination of three lines: second, third and fourth. For them:

$2\cdot 10^{-2}\% < |\delta\lambda| < 5\cdot 10^{-2}\%$, is in this connection we have:

- for the series of Bal'mer - $0,035\% < |\delta\lambda| < 0,3\%$,
- for the series of Pashen - $0,25\% < \delta\lambda < 0,5\%$.

In figure the diagrams of energies $W(r)$ and $Wq(r)$ Coulomb interactions of an electron according to an

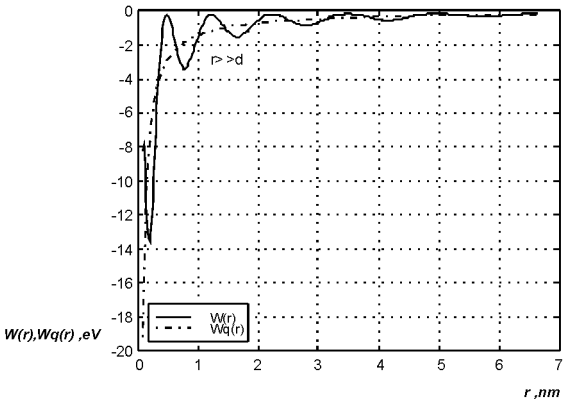

Figure 1: The diagrams of energies $W(r)$ and $Wq(r)$ Coulomb interactions of an electron according to an atomic nucleus charge in considered model of hydrogen atom and proton of the conventional model

atomic nucleus charge in considered model of hydrogen atom and proton of the conventional model are submitted. Essential circumstance is that in considered model the energy $W(r)$, ensuring deriving of a spectrum of the series of Lajman with enough split-hair accuracy, is featured at $r >> d$ by a continuous quasi-aperiodic curve. As if to behavior of an electron near to boundaries of a polarized proton ($r \sim d$), it is problem of the further investigation.

The analysis of the obtained results testifies to an opportunity of making of hydrogen atom polarization model, which will take off the known interior inconsistencies that are in conventional model.

Table 1: Experimental and settlement quantities of a spectrum of hydrogen atom

j	$\lambda_{0j,1}nm$	$\lambda_{j,1}nm$	$\delta\lambda_{j,1}\%$
	The series of Lajman		
2	121,5670	121,5678	$6,00 \cdot 10^{-4}$
3	102,5720	102,5242	$-4,66 \cdot 10^{-2}$
4	97,2537	97,2210	$-3,36 \cdot 10^{-2}$
5	94,9743	94,9558	$-1,95 \cdot 10^{-2}$
6	93,7803	93,7710	$-9,90 \cdot 10^{-3}$
7	93,0748	93,0710	$-4,00 \cdot 10^{-3}$
8	92,6226	92,6218	$-8,40 \cdot 10^{-4}$
9	92,3150	92,3159	$-9,40 \cdot 10^{-4}$
10	92,0963	92,0978	$1,63 \cdot 10^{-3}$
11	91,9352	91,9367	$1,68 \cdot 10^{-3}$
12	91,8129	91,8144	$1,58 \cdot 10^{-3}$
13	91,7181	91,7191	$1,14 \cdot 10^{-3}$
14	91,6429	91,6436	$8,00 \cdot 10^{-4}$
15	91,5824	91,5827	$3,80 \cdot 10^{-4}$
16	91,5329	91,5330	$8,00 \cdot 10^{-5}$
17	91,4919	91,4918	$-1,20 \cdot 10^{-4}$
18	91,4576	91,4574	$-2,60 \cdot 10^{-4}$
19	91,4286	91,4283	$-3,30 \cdot 10^{-4}$
20	91,4039	91,4036	$-3,60 \cdot 10^{-4}$
21	91,3826	91,3824	$-2,50 \cdot 10^{-4}$
22	91,3641	91,3641	$-4.00 \cdot 10^{-5}$
23	91,3480	91,3482	$1,80 \cdot 10^{-4}$
24	91,3339	91,3343	$4,00 \cdot 10^{-4}$
25	91,3215	91,3220	$6,00 \cdot 10^{-4}$
26	91,3104	91,3113	$9,00 \cdot 10^{-4}$
27	91,3006	91,3017	$1,19 \cdot 10^{-3}$
28	91,2918	91,2931	$1,50 \cdot 10^{-3}$

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Table 2: Experimental and settlement quantities of a spectrum of hydrogen atom

j	$\lambda_{0j,1}nm$	$\lambda_{j,1}nm$	$\delta\lambda_{j,1}\%$
	The series of Bal'mer		
3	656,280	654,481	$-2,74 \cdot 10^{-1}$
4	486,132	485,442	$-1,42 \cdot 10^{-1}$
5	434,016	433,773	$-6,29 \cdot 10^{-2}$
6	410,173	410,103	$-1,70 \cdot 10^{-2}$
7	397,007	397,043	$-8,89 \cdot 10^{-3}$
8	388,905	388,191	$2,32 \cdot 10^{-2}$
9	383,538	383,655	$3,05 \cdot 10^{-2}$
10	379,790	379,917	$3,33 \cdot 10^{-2}$
11	377,063	377,191	$3,39 \cdot 10^{-2}$
12	375,015	375,139	$3,31 \cdot 10^{-2}$
13	373,437	373,555	$3,15 \cdot 10^{-2}$
14	372,194	372,305	$2,99 \cdot 10^{-2}$
15	371,197	371,302	$2,84 \cdot 10^{-2}$
16	370,385	370,486	$2,72 \cdot 10^{-2}$
17	369,715	369,812	$2,62 \cdot 10^{-2}$
18	369,155	369,250	$2,58 \cdot 10^{-2}$
19	368,683	368,777	$2,55 \cdot 10^{-2}$
20	368,281	368,375	$2,55 \cdot 10^{-2}$
21	367,935	368,032	$2,80 \cdot 10^{-2}$
22	367,636	367,734	$2,67 \cdot 10^{-2}$
23	367,373	367,477	$2,74 \cdot 10^{-2}$
24	367,148	367,252	$2,83 \cdot 10^{-2}$
25	366,946	367,054	$2,95 \cdot 10^{-2}$
26	366,768	366,880	$3,06 \cdot 10^{-2}$
27	366,610	366,725	$3,15 \cdot 10^{-2}$
28	366,468	366,588	$3,27 \cdot 10^{-2}$

Table 3: Experimental and settlement quantities of a spectrum of hydrogen atom

j	$\lambda_{0j,1}nm$	$\lambda_{j,1}nm$	$\delta\lambda_{j,1}\%$
	The series of Pashen		
4	1875,10	1879,52	$2,36 \cdot 10^{-1}$
5	1281,81	1286,29	$3,50 \cdot 10^{-1}$
6	1093,81	1098,32	$4,12 \cdot 10^{-1}$
7	1004,94	1009,32	$4,43 \cdot 10^{-1}$
8	954,598	958,958	$4,57 \cdot 10^{-1}$
9	922,902	927,145	$4,60 \cdot 10^{-1}$
10	901,491	905,609	$4,57 \cdot 10^{-1}$
11	886,279	890,273	$4,51 \cdot 10^{-1}$
12	875,047	878,928	$4,43 \cdot 10^{-1}$
13	866,502	870,280	$4,23 \cdot 10^{-1}$
14	859,839	863,528	$4,36 \cdot 10^{-1}$
15	854,539	858,153	$4,29 \cdot 10^{-1}$
16	850,249	853,802	$4,23 \cdot 10^{-1}$
17	846,726	850,233	$4,18 \cdot 10^{-1}$
18	843,796	847,268	$4,14 \cdot 10^{-1}$
19	841,332	844,781	$4,14 \cdot 10^{-1}$
20	839,240	842,674	$4,10 \cdot 10^{-1}$
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