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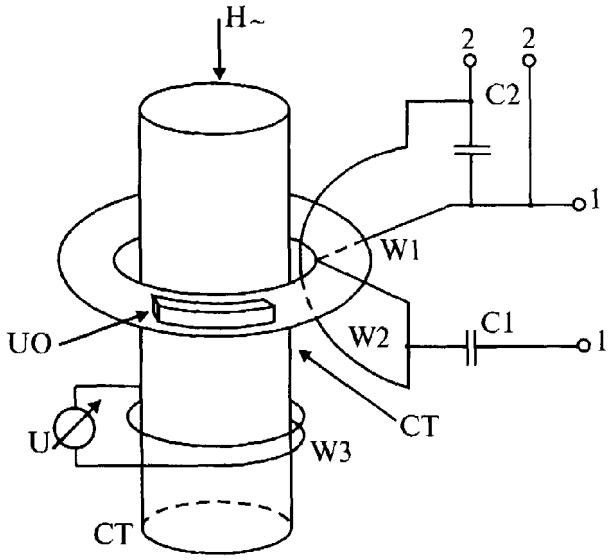

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QUADRADYNAMICS AS THE NEW RELATIVISTIC QUANTUM THEORY OF SPACE, TIME AND FUNDAMENTAL INTERACTIONS

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The results of more than 30-year's author investigations in the field of the relativity theory, gravitation, astrophysics, astronomy, cosmology, electrodynamics and nuclear physics are stated in the paper as thesis report, resulted in the formation of the new stationary (non-expanding) Universe model and a uniform relativistic quantum theory of space, time and physical interactions termed as quadrodynamics.

1. Introduction

In 1984 after 14-year's penetration into the relativity theory, gravitation and a cosmology I have put forward a hypothesis of radius restriction of gravitational interactions by the radius value of the black hole R_0, having density equal to the Universe medial density ρ_0, and the first space velocity on its surface equal to the light speed c. Then I have proposed new coordinate transformations as well, that allowed to prove the inert and gravitational masses identity in the Mach's principle spirit and reveal new properties of the Universe - gravitational viscosity - along with the above-stated ones.

In 1988 I obtained the complete equations of the new theory, which were identified to the equations of the field formulation of the Einstein's General Relativity (GR) with the cosmological constant λ, and the value R_0 was the logic consequence of the new gravitation law as Yukava's potential.

The new coordinate transformations existed from 1984 till 2002 along with Lorentz transformation laws, which were not used by me practically. The attempts of obtaining the Lorenz generalized transformation laws were made in the beginning, while their key inaccuracy was shown in 2002 and the final rejection of the Einstein's' Special Relativity (SR) as the false theory was made. Since then the new theory of space, time and physical interactions began to be termed as quadrodynamics.

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2. New transformations of coordinates

The modern definition of meter and second was given by the solution of XIII (1967) and XVII (1983) General conferences on measures and weights.

The interval $ds^2 = c^2dt^2 - v^2dt^2$ in SR is the invariant in relation to Lorenz transformation laws. But this interval is made on the sides of a rectangular triangle and is valid only for the plane $dy^2 + dz^2 = ds^2$, transiting through the beginning of the moving reference frame and perpendicular its velocity vector. The application of Lorenz transformation laws for other conditions (that is done everywhere) contradicts the above-mentioned definitions of length and time units.

Unlike it in 1984 the author proposed the coordinates transformation group maintaining the whole front of a light wave as invariant and it is used fruitfully till now:

$$dx' = \frac{dx}{1-\frac{v}{c}};\ dy' = \frac{dy}{\sqrt{1-\frac{v^2}{c^2}}};\ dz' = \frac{dz}{\sqrt{1-\frac{v^2}{c^2}}};$$

$$dt'_x = \frac{dt_x}{1-\frac{v}{c}};\ dt'_y = \frac{dt_y}{\sqrt{1-\frac{v^2}{c^2}}};\ dt'_z = \frac{dt_z}{\sqrt{1-\frac{v^2}{c^2}}}. \quad (1)$$

This group presupposes the use of 3-dimensional space and 3-dimensional time that is absolute symmetric to it. They are the consequences of the fact that the gauges of space, time and light speed are the second rank tensors, which geometrical images represent spheres moved regarding the attachment point proportional to the movement rate of one inertial reference frame regarding another one.

3. The choice of field equations and their transformation

As it is known, there are two equation kinds GR:

$$R_{ik} - \frac{1}{2}Rg_{ik} = -\text{æ}T_{ik}; \tag{2}$$

$$R_{ik} - \frac{1}{2}Rg_{ik} - \lambda g_{ik} = -\text{æ}T_{ik}, \tag{3}$$

where: R_{ik} is the Ricci tensor, convolution of the Riman-Christoffel curvature tensor R^l_{ijk}; T_{ik} is the tensor of the substance energy-impulse; g_{ik} is the metric tensor of 4-dimentional spacetime; R is the curvature scalar, convolution of the Ricci tensor; λ is the cosmological constant; $\text{æ} = 8\pi G/c^4$ is the Einstein's constant; G is the Newton's gravitation constant; i, j, k, l =1,2,3,4.

The Universe global evclidity is taken for the unique choice of Einstein's equations, the equality of which is the mathematical expression

$$R^l_{ijk} = R_{ik} = R = 0. \tag{4}$$

As for the real Universe, filled with substance with non-zero density, $\text{æ}T_{ik} \neq 0$, so the fact of the equality non-accomplishment (2) becomes obvious. Thus, only the equations (3) can describe the Universe flat in global gauges. Thus the diversions from flat space - time under gravitating mass affect are represented as the sum

$$\sqrt{-g}g^{ik} \equiv \sqrt{-\gamma}\left(\gamma^{ik} + h^{ik}\right), \tag{5}$$

which corresponds to the assignment of the tensor gravitational field h^{ik} on the background of the flat material world in arbitrary coordinates with the metric γ^{ik}.

The other, no less important property of the Universe is its homogeneity and isotropy on a large scale. Mathematically this property is represented as the zero equality of the covariant derivative of the tensor density $\sqrt{-g}g^{ik}$ and consequences of this equality:

$$\left(\sqrt{-g}g^{ik}\right)_{;i} = \left(\sqrt{-g}g^{ik}\right)_{,i} = \left(\sqrt{-g}h^{ik}\right)_{,i} = 0, \tag{6}$$

where the covariant derivative is designated as semicolon, and the ordinary one is designated as comma.

Furthermore the equations (3) are given to the equations of the field formulation GR with the transformation (5) and the requirement (6) - like the Lorenz calibrating requirement in electrodynamics (but obligatory here!):

$$\Box h_{ik} - \frac{2}{3}\lambda h_{ik} = 2\text{æ}T'_{ik}, \tag{7}$$

where: $\Box$ is the Dalamber's operator (dalambertian); T'_{ik} is the tensor of the substance energy-impulse along with the gravitational field.

The requirements (6) in the mathematical sense are equivalent to the traditional equations GR addition of four equation sets, missing up to completeness, then the problem of the Universe real properties explanation becomes solvable without any additional and ungrounded assumptions.

4. The gravitation law

If the equation (7) can be applied to a material body - the gravitational perturbation source, so having taken the component 00 and multiplied it by the light speed quadrate, we shall obtain the expression as the Klein-Gordon's equation, known from a quantum mechanics, for a gravitation potential outside a body

$$\Box\varphi - \frac{2}{3}\lambda\varphi = 0. \tag{8}$$

The equation (8) gives the exterior solution as the Yukava's potential in a static case for the spherical-symmetric material body of the mass m

$$\varphi = -\frac{Gm}{r}\,\mathrm{e}^{-\frac{r}{R_0}}. \tag{9}$$

The following relativistic gravitation law is obtained for two material bodies with the masses m_1 and m_2

$$F = G\frac{m_1 m_2}{r^2}\,\mathrm{e}^{-\frac{r}{R_0}}\left(1 + \frac{r}{R_0}\right). \tag{10}$$

where the constant R_0 is termed as the gravitational interactions radius and is determined through the Universe medial density ρ_0 and relative light speed c' according to the formula

$$R_0 = c'\sqrt{\frac{3}{4\pi G\rho_0}}. \tag{11}$$

In linear approach the gravitation law looks like:

$$F \approx G\frac{m_1 m_2}{r^2}\left(1 - \frac{r^2}{R_0^2}\right), \tag{12}$$

which shows, that all material bodies in the Universe interact with each other practically only within gravitational interactions radius equal to 10^{-26} m (or 20 billiard of light years) approximately.

5. Basic law of dynamics

The detailed analysis of a material body interaction with the entire Universe masses has shown at its dispersal that the character of this interaction varies in a complicated way: the interaction of a dispersed body with the Universe weakens in a back hemisphere, and it amplifies in the forward one, on the contrary.

It can be explained more simply at the linear approach use of the actual gravitation law (13). According to this approach, the material body interacts with the Universe medium only within the gravitational interactions radius R_0. The interaction area moves forward along its motion without changing the form at the body dispersal proportionally the body velocity ratio to the light speed.

The author has found the way allowing determining the quantitative dynamics performances of this interaction and show, that the second Newton's laws is this interaction consequence. And there is a gravitational mass instead of traditionally accepted inert one in the second Newton's law automatically. Thus, the author proves the identity of inert and gravitational masses in the Mach's principle spirit. In other words, it is proved, that no inert mass exists, and the inert properties of material bodies are shown through the gravitational interaction with the entire Universe masses (more precisely, through this interaction change). The centrifugal forces are explained similarly at revolution, reflecting the third Newton's law.

The dispersal field (cancellation of the local force action) of the material point along the coordinate X its free motion is described by the equation - the basic dynamics law

$$\frac{d^2X}{dt^2} + H\frac{dX}{dt} = 0, \tag{13}$$

where H is Hubble's parameter, which is defined according to the formula

$$H = \sqrt{\frac{4\pi G\rho_0}{3}}, \tag{14}$$

it has absolutely other physical sense as well, than it is accepted in a traditional cosmology.

6. Gravitational viscosity of the Universe

The new law of a free motion differs from the first Newton's law by the second (dissipation) addend available. As a whole one of the simplest law formulations is: if the local forces do not affect upon the body, so the location of its interaction area with the Universe (as for the level R_0) does not vary in due course, and it aims to the area center asymptotically.

As the body velocity diminution is proportional to the velocity itself, instead of its quadrate, as it is observed in aerodynamics, such property is termed as the Universe gravitational viscosity (by analogue to any other medium viscosity). Whereas the Hubble's constant value has the order 10^{-18} 1/sec, so the gravitational viscosity available has almost no affect upon local processes (for example, within the Solar system). Remote, equal to half of medial distance between galaxies, the forces of gravitational viscosity become comparable with centrifugal forces and reply for the formation of the Universe medium dimension structure, i.e. for galaxies formation (they explain their helicity as well).

As the further investigations have shown, that the gravitational viscosity occurred identical to the ether viscosity. The abnormal retardation of space vehicles "Pioneer - 10" and "Pioneer - 11," left beyond the Solar system and non-explained by anybody yet is stipulated by the viscosity available (about 10^{-10} m/sec^2).

At revolution of major bodies and their systems (planets, stars, galaxies) the gravitational viscosity at the lack of the ether entrainment should result in the angular velocity retardation of their revolution (their components) ω according to the law

$$\frac{d^2\omega}{dt^2} + H\frac{d\omega}{dt} = 0. \tag{15}$$

It is known from long-term observations that the period of the Earth's daily revolution for 100 years increases in $2\cdot10^{-3}$ sec. The estimation of ether viscosity influence for its densities range from medial to galactic one in the Universe (in the Solar system location) according to the formula (4.) gives the day enlargement for a century equal to $1.2\cdot10^{-3}$-0.33 sec. The ether density improvement and the estimation of its rotated bodies entrainment result in these data improvement.

In recent years the formula for ether dynamic viscosity definition at the substance travel has been deduced of

$$\eta = \frac{Hm_p}{6\pi r_p}. \tag{16}$$

where m_p and r_p are the proton mass and radius accordingly.

In turn the ether kinematics viscosity ν is determined through its mass density ρ_E according to the formula

$$\nu = \eta/\rho_E. \tag{17}$$

It's dynamic (10^{-32}–10^{-29}) and kinematics (10^{-5}–10^{-3}) viscosities (more precisely the ether kinematics viscosity is defined experimentally by the Kharkiv citizen I.M. Galaev — $6.24\cdot10^{-5}$) and estimated for the above-stated range of the ether densities.

7. Geodetic curvature of the Universe

The concept of the Universe gravitational viscosity adjoins closely to the concepts of affine transformations (parallel transport of a vector) in noneuclidean geometry. For the motion of non-conservative systems - i.e. in the mostly general view - there is a ratio for the space curvature

$$K^j(t) = \frac{d^2X^j}{dt^2} + \Gamma^j_{lk}\frac{dX^l}{dt}\cdot\frac{dX^k}{dt} = \varphi(t)\frac{dX^j}{dt}. \tag{18}$$

The medial summand with the Cristoffel's figures of the first kind (affine coherency) Γ^j_{lk} specifies the space curvature degree (we shall term it as geometrical), in which there's the parallel vector transport, and the last - on the vector length change, i.e. the energy dissipation existence. It determines so-called geodetic space curvature

$$K = \sqrt{g_{ij} K^i(t)\, K^j(t)}, \tag{19}$$

about which there's almost no mention even in the special literature as to GR.

The geodetic curvature for the real Universe is equal:

$$K = Hc', \tag{20}$$

where $\mathbf{c}' = \mathbf{c} - \mathbf{v}$ is the relative light speed and $K_0 = Hc$ is the constant coefficient for the Universe equal to approximately 10^{-10} m/sec^2 (free fall acceleration on the material body with the radius R_0 and density ρ_0).

As a whole all the results analysis shows, that the motion regarding the Universe carries the absolute motion character, but it cannot be noticed as for the local physical laws action (except for red bias in radiation spectrums of remote galaxies).

8. The law of light distribution

The analysis of light interaction with the Universe material medium has shown, that it is influenced by the gravitational potential $\Phi_0 = -c^2$, resulting in its energy losses and, consequently, the frequency change ν in relation to the initial ν_0 according to the law

$$\nu = \nu_0\, \mathrm{e}^{-\frac{r}{R_0}}. \tag{21}$$

The law completely solves the photometer paradox, explains the red bias nature in radiation spectrums of other galaxies without Doppler's effect attraction and results in the new formula of the distances definition up to galaxies:

$$L = R_0 \ln(1+z), \tag{22}$$

where $z = \frac{\lambda - \lambda_0}{\lambda_0}$ the red bias parameter of light frequency expressed through waves length of radiated λ_0 and accepted λ light.

The law (20) has some deduction variants with quantum mechanics use. It has appeared as well in view of the field quantization, that the peak propagation distance of electromagnetic radiation (at the initial frequency 10^{23} Hz) is equal to $173\, R_0$.

The author has offered also the fundamental physical experiment as for the demonstration of the light frequency diminution and the ether density definition in laboratory conditions.

9. Hubble's diagram

The dependence "visible star value m - the red bias z" (the Hubble's diagram) looks like taking into account the new law of light distribution

$$m = 5 \lg\left[\sqrt{1+z} \ln(1+z)\right] + 21.68 \tag{23}$$

and it coincides completely with the experimental data, and the dependence is almost linear in the range of the observed star values.

10. Microwave background radiation

The law (20) completely explains the nature, numerical performances and the allocation character of microwave background radiation. Actually it is not the Major Explosion relict, but the total radiation of all electromagnetic radiation sources (stars, galaxies, quasars etc.) of the Universe. If the whole radiation as for space from zero ad infinitum, falling onto the separate platform can be integrated, so this radiation temperature will be determined by the formula

$$T_0 = \sqrt[4]{\frac{L_S \theta \rho_0 R_0}{4\sigma M_S}}, \tag{24}$$

where M_S, L_S is the medial mass and complete radiation flowing of a medial star (or galaxy); σ is the Stephan-Boltzman constant, θ is the stars share in the Universe medial density ρ_0.

It is known, that the mass of a medial star is equal approximately 0.4 of the Sun mass. Then, if to substitute this mass value $M_S = 0.8 \cdot 10^{30}$ kg and star brightness, relevant to it $L_S = 1.1 \cdot 10^{25}$ W, and also $\sigma = 5.67 \cdot 10^{-8}$ W$\cdot$m$^{-2}\cdot$ K^{-4} and the value $\rho_0 \approx 10^{-26}$ kg/m^3 (i.e. $\rho_0 R_0 \approx 1$) into the formula (25), so the temperature of equilibrium radiation of all stars will be equal to $T_0 = 2.64 - 2.79$ for $\theta = 0.8 - 1.0$, that coincides with actual measurements of this value $(2.726 \pm 0.005$ K).

The analysis of this radiation spectrum has shown that it corresponds to the radiation spectrum of an absolutely black body. Thus, the microwave background radiation and red bias in radiation spectrums of other galaxies is not the Big Bang result.

11. Gravitational resonances

The equations GR with a cosmological constant in the field form look like a wave equation, at which there is a certain resonant frequency $\omega_0 = H$ in an obvious view dependent upon the body density. As the densities of space bodies vary as to depth, so there should be a set of resonant frequencies for each body.

The calculated resonant frequencies of the Earth lie in the range from 10^{-6} up to 10^{-4} Hz. These oscillations relate to gravitational waves spreading with the light velocity in various Earth's stratums, its ocean and atmosphere, but they are not identical to seismic waves, their propagation velocities do not exceed 7 km/sec, and the oscillation frequencies are basically in the range from 10^{-4} up to 10^{-2} Hz.

The Earth's gravitation-resonant frequencies available means nothing itself, but these frequencies concurrence to exterior affects of astronomical character can result in the oscillation amplitudes addition in particular points of the Earth and cause cataclysms such as: earthquakes, tsunami, convulsions of nature.

The acknowledgement search has shown, that the Earth's oscillations of electromagnetic and gravitational fields in a resonant frequency band have already been noticed, they are the subject of systematic observations and correlate with the relevant frequencies affects of astronomical objects and their systems upon the Earth.

The calculations of the Sun resonant frequencies have shown that there is such pulsation among them, which corresponds to known ones with the period of 160.1 minutes. This frequency concerns to the Sun stratum in the depth approximately 0.5 of its radius and, obviously, is responsible for cyclic energy exchange between the interior parts, where there are thermonuclear reactions, and the exterior part, where such reactions do not occur.

The Galaxy resonant frequency was defined for the substance density in the Solar system location. The wavelength relevant to this resonant frequency has appeared equal to the distance between the neighboring Galaxy sleeves.

12. Gravitational substance screening

The actual gravitation law results in the important consequence – the mass of a material body, shown in interactions, depends upon the body radius ratio R and the gravitational interactions radius R_0:

$$M = \frac{R^2 c^2}{2GR_0}\left(1 - \mathrm{e}^{-\frac{2R}{R_0}}\right). \tag{25}$$

The body mass is proportional to its volume at $R << R_0$, and at $R >> R_0$ (or, the same, when $R \to +\infty$) — the body surface area. It suggests the idea about the quite precise explanation of the virial paradox and existence of the Universe gravitation-closed areas.

The radius of gravitational interactions (12) is of interest in physical sense as well. It appears that it corresponds to the black hole radius exactly, the light velocity on its surface is equal to the first space velocity, and the gravity acceleration is equal to the gravitational curvature (4.). Thus, it can be told, that we live in the black hole center, but it is not our privilege, but the Universe peculiarity to form the gravitation-closed area around any point.

On the other hand, if to unit two identical material objects into one, without changing density, so the mass, shown in interactions, of the integrated object will be less than total component mass. It should be expected also, as the actual gravitation law (10) is formally similar to the nuclear interactions law in the field theory of nuclear forces.

The revealed regularities show a key opportunity of the artificial gravitational screen creation and the construction of flying apparatuses such as "UFOs".

13. Large-scale structure of the Universe

The actual law of gravitation (10) has a series of other pleasant features as well. So, the calculation of the gravitational bond energy of the material body mass m with the whole Universe gives the value

$$E = -mc^2, \tag{26}$$

which is equal to the body interior (i.e. nuclear) energy exactly taken with the opposite sign. In contrary to it, the Newton's gravitation law gives a minus perpetuity. That is why Zee liger's gravitational paradox also has appeared with Newton's laws application to the infinite Universe. Such paradox does not exist in the real Universe with the actual gravitation law, and mass acts as the binding measure of a material body with the Universe.

There is a special theorem in classical physics, proving that the gravitational field misses or, more exactly, that the resultant force of all gravitational forces is equal to zero inside the spherical-symmetric material radius shell R. It has appeared with the use of the actual gravitation law (10), that such shell (with the mass M_Θ) draws the material point of the mass m, being inside its inner cavity, with the force

$$F_\Theta = \frac{GmM_\Theta}{r^2}\frac{R_0}{2R}\times$$
$$\times\left[\mathrm{e}^{-\frac{R+r}{R_0}}\left(1+\frac{r}{R_0}\right) - \mathrm{e}^{-\frac{R-r}{R_0}}\left(1-\frac{r}{R_0}\right)\right]. \tag{27}$$

The formula (28) analysis shows, that if the point is closer to a shell (r is the distance between the center of a shell and point), so it is drawn to it more strongly. In other words, any density increase of the Universe material medium as a shell (for example, in case of fluctuation) result in the further formation of such a shell. That is why the Universe has cellular structure in major ranges (as soap foam), where the galaxies cluster is in thin walls of these cells, and super cluster is in the cell intersections.

The data for 23760 quasars were used as two angular coordinates Θ, φ and red bias of the radiation spectrum z for the investigation of the actual substance allocation in the Universe. The distance up to quasars was determined according to the formula (21), which capability was successfully tested at the analysis of the Universe photometer properties.

Then Delone's triangulation for the Universe thin layers and statistical processing of the distances between quasars, received in such a way, were carried out.

As a result of this investigation the authors set the regularity in quasars allocation unknown earlier meaning that they are grouped in thin cell walls with the medial size about 50–100 Mps, filling the whole observed part of the Universe as foam homogeneously. The received results coincide with galaxies allocation and the new model of the stationary (non-enlarging) Universe.

The character of quasars allocation in the Major Explosion model was tested along with it. Thus it was shown, that the revealed cells in the Universe periphery (i.e. closer to the presupposed explosion moment) have no spherical symmetry that contradicts the explosion theory. It puts the Major Explosion idea and the Universe expansion under doubt.

14. Cosmological values

The equation such as (8) shows, that the interactions carrier is the ether particle - amer with the mass

$$\mu = \frac{\hbar}{R_0 c}. \tag{28}$$

This mass is approximately equal to 10^{-69} kg, which is less than the electron mass ($m_e/\mu \approx \approx 10^{-30}/10^{-69} = 10^{39}$) in 39 times. But there is a dimensionless ratio with the proton mass use m_p in the physics of atomic nucleus and elementary particles

$$\gamma = \frac{\left(m_p^2 G\right) / \left(\hbar / m_p c\right)}{m_p c^2}, \tag{29}$$

which is termed as the gravitational constant in natural atomic units and known precisely: $5.902 \cdot 10^{-39}$.

All basic cosmological values are precisely defined in view of the above-stated:

— the amer mass (the ether particle):

$$\mu = \frac{m_p^2 m_e G}{\hbar c} = 5.3787664 \cdot 10^{-69} \text{ kg}; \tag{30}$$

— the radius of gravitational interactions:

$$R_0 = \frac{h^2}{4\pi^2 m_p^2 m_e G} = 6.5399303 \cdot 10^{25} \text{ m}; \tag{31}$$

— the Universe medial density:

$$\rho_0 = \frac{12\pi^3 G c^2 m_p^4 m_e^2}{h^4} = 7.5181695 \cdot 10^{-26} \text{ kg/m}^3; \tag{32}$$

— the Hubble's constant:

$$H = \frac{4\pi^2 G c m_p^2 m_e}{h^2} = 4.5840313 \cdot 10^{-18} \text{ sec}^{-1}; \tag{33}$$

— the cosmological constant:

$$\lambda = \frac{24\pi^4 G^2 m_p^4 m_e^2}{h^4} = 3.5070747 \cdot 10^{-52} \text{ m}^{-2}; \tag{34}$$

— the Universe part mass enclosed in the radius R_0:

$$M_0 = \frac{4\pi R_0^3}{3}\rho_0 = 8.8088675 \cdot 10^{52} \text{ kg}; \tag{35}$$

— the Universe medial wavelength:

$$\Lambda_0 = 2\pi R_0 = 4.1091593 \cdot 10^{26} \text{ m}; \tag{36}$$

— the minimal energy "quantum":

$$E_{min} = \mu c^2 = \hbar H = 4.8341941 \cdot 10^{-52} \text{ W} \cdot \text{sec}; \tag{37}$$

— the maximal energy "quantum":

$$E_{max} = M_0 c^2 = 7.9170152 \cdot 10^{69} \text{ W} \cdot \text{sec}; \tag{38}$$

— the amer density:

$$\rho_\mu = \frac{6\pi^2 c^3 m_p^2 m_e}{h^3} = 1.3977594 \cdot 10^{43} \text{ m}^{-3}; \tag{39}$$

— the medial distance between amers (equal to the Compton's wave length of a proton):

$$L_\mu = \frac{1}{\pi \sqrt[3]{\rho_\mu}} = 1.3214152 \cdot 10^{-15} \text{ m}. \tag{40}$$

The knowledge of the Universe specified performances allows solving a series of practical problems exactly. In particular, it enables to specify the distances up to other galaxies and quasars, build the Universe model precisely, calculate the trajectories of space ships motion at prolonged flights in major distances etc.

15. Quadrodynamics equations

The general quadrodynamics equations look like:

$$\blacksquare \varphi_{ik} - k_1^2 \varphi_{ik} = k_2 T_{ik};\ i,k \in \{x,\ y,\ z,\ t_x,\ t_y,\ t_z\}, \tag{41}$$

where

$$\blacksquare = \left(\frac{\partial^2}{\partial x^2} - \frac{1}{c_x^2}\frac{\partial^2}{\partial t_x^2}\right) + \left(\frac{\partial^2}{\partial y^2} - \frac{1}{c_y^2}\frac{\partial^2}{\partial t_y^2}\right) + \left(\frac{\partial^2}{\partial z^2} - \frac{1}{c_z^2}\frac{\partial^2}{\partial t_z^2}\right) \tag{42}$$

is the Zhuck's operator;

$$k_1^2 \equiv \frac{2}{3}\lambda \equiv \frac{1}{R_0^2} \equiv \frac{H^2}{c^2} \equiv \frac{\omega_0^2}{c^2} \equiv \frac{\mu^2 c^2}{\hbar^2} \tag{43}$$

is parameters coupling coefficient; $k_2 = 2æc^2$ is coupling coefficient with a material tensor (in case of gravitation).

Here $\varphi_{ik} = h_{ik}c^2$ is the ether deformation tensor dependent upon the material bodies or particles available in ether (with the energy-impulse tensor T_{ik}), larger than amer.

The quadrodynamics equations are reduced to the electrodynamics wave equations for free ether

$$\Box\varphi_i - k_1^2\varphi_i = 0, \quad i \in \{x,\ y,\ z,\ t\}. \tag{44}$$

As it appeared, there are twice more electrodynamics equations, than it follows from the Maxwell's theory.

According to the author's last investigations, the ether represents stationary plurality of alternating negative and positive particles - amers of the charge different sign, which represents some kind of cold plasma, in which particles occupy the places with clearly expressed potential energetic holes. The particles bond with their places is extremely weak, and it destroys quickly and easily at the exterior affect (for example, intrusion of large particles or material bodies). But the ether structure is recovered after the affect termination. Such structure provides the transit of both cross and longitudinal waves.

16. Gravitational waves

The wave solutions of the equations (7) in lack of gravitational field sources, i.e. at the zero right part, are identified with electromagnetic waves according to the following features:

1. Identical distribution velocity equal to c.

2. Uniform carrier of interactions — the ether particle with the mass $\mu = 10^{-69}$ kg.

3. Identical law of the frequency change with the distance $\nu = \nu_0\, e^{-r/R_0}$, where R_0 is the cosmological radius.

4. Identical frequency band: from 10^{-18} up to 10^{23} 1/sec.

5. Identical polarization — orthogonal.

The new results have shown up as well:

— lower non-zero frequency of electromagnetic waves propagation range equal to 10^{-18} 1/sec;

— physical sense of the Plank's constant multiplied by the minimal frequency 10^{-18} 1/sec — the amer energy, the ether particle;

— additional unknown electrodynamics equations, which describe longitudinal electromagnetic waves and longitudinal interaction of parallel currents.

17. The nature of fundamental interactions

X. Lorenz proposed the hypothesis 100 years ago that the gravitational interactions can be the result of non-compensation of electrical interaction forces. B. Kaleganov found the reason of forces asymmetry: each charge is drawn to all charges of the opposite sign, and repelled from all charges of one sign minus a unity (it is not repelled from itself).

In further these ideas resulted in the investigation of multi-field interaction (according to the Coulomb's law) of the neutral bodies electrical charges by numerical modeling on the computer. It was found out as a result of modeling, that both the combined force and its change law regarding the distance increase do not depend upon charges number (at the body constant sizes).

However the main result was the fact that the law of the multi-field potential change depending upon the distance is approximated with high accuracy by the function corresponding to Newman-Yukava's potential. Thus the electron multi-field potential consisting of amers with the mass 10^{-69} kg, has appeared in 10^{39} weaker than usual electrical potential that corresponds to gravitational forces. And multi-field interaction of electrons and positrons in an atomic nucleus has given the potential relevant to nuclear forces.

18. Conclusion

Quadrodynamics is grounded upon the mathematical apparatus GR (i.e. on the tensor calculation and differential geometry of multidimensional spaces), but it represents a new relativistic quantum theory of space, time and fundamental interactions with 6-dimensional space and time as to its content.

I see the basis of this theory further development and its practical application in the electrodynamics equations investigation unknown earlier, the realization of electrodynamics and radio engineering experiments, as well as in the development of free energy generators, new flying apparatuses such as "UFOs" and teleportation devices - these ¡gates of various worlds¿. I'll be glad, if other enthusiasts join this paper.

I see only their peaceful use as the indispensable requirement of all above-stated investigations, because the military application of so cardinal control methods of nature calamities is fraught with negative consequences, more terrible than nuclear war. That's why the knowledge of these methods cannot be published freely in modern conditions and be accessible for those, who can use them for Mankind harmfully.

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NUCLEAR CONVERSIONS IN LOW ENERGIES

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The theoretically predicted and experimentally obtained phenomenon of ferromagnetic matter nuclear transformation in low energies. The discovery has served as the beginning of intensive investigations of a new trend in physics — in nuclear reactions physics of cold synthesis.

1. Introduction

A lot of attention is given to nuclear physics now. However, the nuclear power engineering is limited to few members and, as a rule, it finishes by uranium and plutonium. Uranium (235) disintegrates into barium and krypton at the energy level about 250 MeV. The fragments of uranium disintegration, including neutrons, are stopped, forming heat oscillatings of molecules. Other methods of thermal energy obtaining without neutron outbursts with high energy are not found. Therefore the heavy crisis of outlooks has occurred in a nuclear physics. Somebody considers that the nuclear reactions in small energies are impossible in general, and others acknowledge the erratic concepts. For example, the helium synthesis of deuterium is almost impossible in Tokamak, but there are huge expenditures of financial and human resources all the same. We have confirmed, that the nuclear transformations in small energies are probable [1].

2. Premises to nuclear transformations in small energies

The nuclear transformations are observed in many examples. We can judge about them according to heat emission. Some reactions go with heat energy release, and some - with its consumption. Let's take the thermoelectric couple of iron and nickel. If to skip the direct current through iron-nickel junction, the junction will either be warmed up or chilled. Let's pay attention to a junction heat-up. The junction heat release exceeds the thermal energy of Jowl heat considerably. This known fact for a long time was explained by an operating principle of a calorific pump. The calorific pump, working in gases compression and decompression, is applied in fridges. But the heat pump in electric networks misses, i.e. heat is not transmitted by an electric current. The heat release in a hot junction is determined only by atoms hardening of joint metals. We discover the cobalt isostere formation in the example of iron-nickel junction according to the schema:

$$Ni_{58}^{28} + Fe_{56}^{26} \rightarrow Co_{57-55}^{27} + Co_{57-55}^{27} + W.$$

This reaction goes in a supersmall voltage arc (actual stress does not exceed several volt fractions in contact of iron-nickel junction) in which the electron current goes from a cathode electrode to anode one, and towards — positively charged protons of hydrogen atoms. The generated cobalt is tighter, than nickel and iron. Therefore we shall observe heat release at minus polarity on iron, and chilling — at plus polarity, since the protons will be displaced from iron to nickel according to the schema:

$$Ni^{28} + Fe^{26} \rightarrow Cu^{29} + Mn^{25} - W.$$

Generated copper and manganese are more friable, than nickel and iron [16].

We shall pay attention without other schemas viewing of nuclear reactions at the expense of hydrogen protons moving that these nuclear reactions are not of neutron operating, but electron-proton. It gives the essential advantage in creating controllable nuclear reactors. Let's stop on the brief review of consequent steps to discovery of electron-proton nuclear reactors. For the first time authors have elaborated the speed-up methods of charged particles and the appropriate request for the invention was made out in 1961 [17]. The series of discoveries was made on the basis of iron-nickel alloys. So, the law of a magnetic circuit was formulated at the beginning [18]. Then the radiating effects [19] and chain reactions in nuclear processes [20] were opened. In the works [21, 22] the ferromagnetism positions are substantiated again on the effects of Peltye and Zeebek, i.e. on atomic thermal elements. The positions of the announced laws are developed in the works [23, 24, 25]

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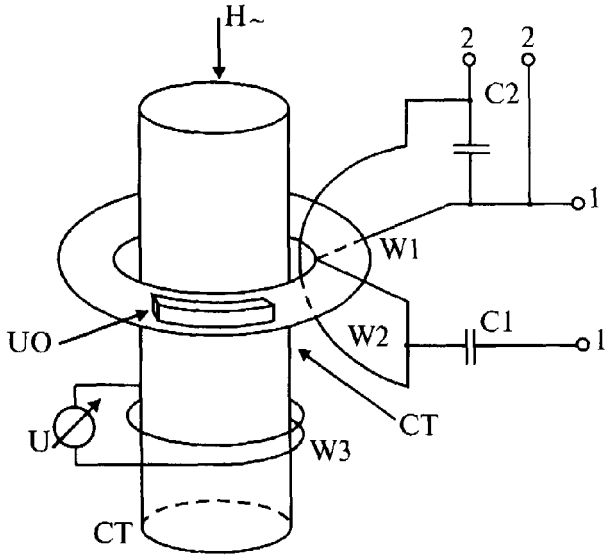

Figure 1: The experimental machine for nuclear investigations conducting

and the discovery request [12]. The major experimental works were described in [13]. The results of consequent investigations were explained in the invention requests [14, 15, 16, 17]. Then the information of Fleyshman and Ponce appeared [18], then [19, 20, 21] appeared. The reference materials were used at the izostere table compiling [22, 23].

3. Experimental investigations

The experimental investigations were carried out on the operating machine (Fig. 1). It represents an induction furnace working with additional non-inductive reels W1 and W2, uniformly wired on the tore-like frame with windows for input a tore cavity of the examined samples inside (UO), disposed in hard-melting zirconium or graphite crucibles (CT).

The reels W1 and W2 have identical number of coils, but have different wire section. As these reels are counter connected, so their total induction is equal to zero point, though the current, flowing through them, will be different. If the wire section of one reel can be taken equal 0.1 section by another, the resulting ampere turns will be diminished only by 10%. But the required induction vortex currents through the examined samples (UO) can be obtained on frequencies up to 300 MHz.

The resonance spectrogram of substance atom elements (UO) was detected at induction device testing (Fig. 1). The spectrogram parameters were made by the detecting instrument (U), connected to the winding W3, put on the rod (CT), which could be executed of the same matter, as UO. Generally the material CT is the nucleus of transformer iron induced into UO the longitudinal current on a ring, which was brought up to 10^6 A/mm^2 in separate occasion at impulsive currents at the expense of reels W1 and W2 windings.

Though there can be a melt vaporization at such current densities at the expense of abnormal release of a thermal energy, so these current densities are set as short impulses (up to 0.1 secs).

The spectrogram nature changes at constant biasing switching on in the circuit 2 — 2. The windings W1 and W2 are switched on accordingly (sequentially) for a constant biasing.

The constant and variable biasing UO on high frequencies (especially on resonance frequencies), as it was noticed by us, create powerful electronic Lamor precessions and spin waves, on one hand, and, on the other hand, such vigorous oscillatings of hydrogen atoms and alpha-particles result in their transferring into those energy spaces, in which they are arranged more tightly. Thus, it was possible to detect the nuclear matter regroup having magnetic and superconducting properties with the experimental unit depicted.

It was proved while studying the experiment nature, that ferromagnetism and superconductivity have much in common. The superconductivity is the basis in them. In other words, the ferromagnetic is an alloy of superconducting matters with ordinary conductivity. Really, if to apply to a zero series of the Tab. 2 [2], we shall remark, that the elements are arranged in this series, aliquot to number 9 (i.e. fluorine, among which F, Ar, Kr, Xe are gas-like, as well as cobalt and other metals). Let's consider cobalt. On one hand, its nucleus consists of three fluorine atoms, or from one fluorine atom and one - argon, and, on the other hand, cobalt, being in the group of manganese, iron, nickel, copper and others, has strong metallic properties. In other words, cobalt combines the properties of two matter states simultaneously: the metallized gases and metals.

The inert gases Ar, Kr, Xe, having small ionization potentials (are less, than He and Ne, as well as the series of alkaline elements), make them as strong oxidants, for example XeF_8, XeO_4, $XeOF_6$. Cobalt has the similar properties also, which has the same combinations, as rare gases KrF_2, XeF_2, KrF_4, XeF_4, RnF_4, CoF_2, CoF_4, CoF_6, CoO_4, CoF_8, $CoOF_6$.

But here major is in those that cobalt in interaction with other elements forms superconducting domains. Though cobalt in the considered device undergoes nuclear transformations itself as well. Really, it turns into iron and nickel under the neutrons weak background operating at impulsive currents densities through a cobalt melt (about 10^7 A/mm^2) and the induction impulses duration (up to 0.1 secs). The frequency of impulse following was limited by mean bath temperature, which was maintained at the level 2500^0C. New spectrograms were made and compared with original in ten hours of a reactor. The lines ISP-22/28 2407.3 Å, 2411.6 Å, 2424.9

Å, 2589.7 Å, 3044.0 Å, 3405.1 Å, 3412.3 Å, 3449.4 Å, 3453.5 Å, 2414.5 Å, were detected by a spectrograph at cobalt before current supply.

The frequency 2589.7 Å shifted on a line part 2599.39 Å after current supply. The frequency 3044.0 Å shifted to the part 3020.64 Å. All of them belong to iron, and the frequency 3050.8 Å appeared at the frequency 3044.0 Å, the frequency 3414,77 Å appeared at the frequency 3412.3 Å and the new frequency 2943.9 Å appeared. All of them belong to nickel.

These data testify that coupled cobalt atoms will be converted by hydrogen nucleus transferring from one cobalt atom to another. The atoms of iron and nickel are formed as a result of the specified reaction according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow}\overset{\nearrow H_{1-3}\searrow}{Co^{27}_{59}+Co^{27}_{59}}=Fe^{26}_{56-58}+Ni^{28}_{60-62}+W. \qquad (1)$$

Here $W = 2W_{Co} - W_{Fe} - W_{Ni} = 2 \cdot 18.649 - 15.707 - 19.123 \approx 2.5$ MeV.

The reaction goes well at small radiating by neutrons or protons. They promote powerful chain processes originating and additional neutrons formation. Despite of small energy, participating in neutron reaction, it is necessary, on one hand, to put neutron mirrors (for example, zirconium ones), and on the other hand - it is necessary to be screened from them simply. We used bronze rings with the thickness up to 100 mm in an experimental unit.

The reaction (1) is convertible, and, if current high density impulses can be passed through a melt of iron and nickel (up to $10^{4\ldots7}$ A/mm^2, the duration about 0.1 sec, so cobalt frequencies occur in iron and nickel spectrogram. Naturally, the reverse reaction goes with energy absorption. The similar nuclear reaction goes in boronozon B_2N_2 as well. Really, if boronozon can be sated with heavy hydrogen atoms (deuterium or tritium) and except of a direct current "capturing" hydrogen ions into crystal lattice of a boron azide it is necessary to pass short current impulses through it (up to 0.1 sec) with the density up to 10^6 A/mm^2.

Besides it is necessary to approach a small level of stranger neutrons for nuclear reaction beginning. Naturally, boronozon should have a critical mass, it should be surrounded by zirconium mirrors and have good personnel protection against neutron radiating, occurring in a natural nuclear process.

Tritium atoms will be divided into pieces under the action of impulsive currents and excited neutrons (2 neutrons, 1 proton, 1 electron).

$$\overset{i\Rightarrow}{n^0\Rightarrow}T \Rightarrow 2n^0 + p + e^-. \qquad (2)$$

The explosive tritium process can result in excess of one hydrogen atom or its proton either from a boron nucleus, or a nitrogen nucleus. Thus carbon atoms as well as beryllium and oxygen atoms can be created. Apparently the reactions go according to the schemas:

$$\overset{i\Rightarrow}{n^0\Rightarrow}\overset{\nearrow H_{1-3}\searrow}{B^5_{11} + N^7_{15}}=Be^4_{8-10}+O^8_{16-18}+W_1; \qquad (3)$$

$$\overset{i\Rightarrow}{n^0\Rightarrow}\overset{\nearrow H_{1-3}\searrow}{N^7_{15} + B^5_{11}}=2C^6_{12-14}+W_2. \qquad (4)$$

Here $W_1 = W_B + W_N - W_{Be} - W_0 = 3.181 + 4.167 - 2.504 - 4.55 = 0.294$ MeV; $W_2 = W_N + W_B - 2W_C = 3.181 + 4.167 - (2 \cdot 3.029) = 1.29$ MeV.

Both reactions go with energy release. If graphite can be sated with deuterium and tritium and the abovementioned impulsive currents can be passed through it, so the nuclear reaction (2) can go backwards partially. It was pointed out in [9], that iron-nickel thermal elements have the best thermoelectric properties. It is clear, since they are explained by pseudo-nuclear processes of iron and nickel transforming into cobalt. In other words, we deal with nuclear thermo-EMF-effect, describing the interrelation of nucleus members and currents.

The ferromagnetism arises on the basis of nuclear rearranging, at which superconducting domain structures occur. As cobalt is an example of transformations and has a rather simple nuclear structure, so we shall determine possible boundaries of such nuclear transformations and establish a molecular or nuclear component of superconducting matter. It is considered that cobalt in alloys with platinum or samarium Co_5Sm has major magnetic energies (composition BH). The strong magnetic properties are detected in other alloys as well, which after ingredient fusion were chilled in strong magnetic fields. Due to the fact that nuclear transformations occur at ferromagnetic matter forming, we shall give some experimental data.

The vikaloy alloy was manufactured of well-purified 51% Co, 1% V, 37% Fe from impurities. The spectrogram was taken off from prototype after fusion. Chrome 2986.47 Å, 2905.5 Å lines (near cobalt line 3044.0 Å) were detected except of cobalt, vanadium and iron lines. The vanadium line 2682.9 Å and 2683.1 Å shifted to the site 2663.0 Å, specific for chrome. And the chrome line 2686.57 Å was formed of iron line 2990.4 Å. The new chrome frequencies, such as: 2843.25 Å, 2860.9 Å, 2849.8 Å, 2835.6 Å appeared. The silicon and magnesium frequencies were detected as well. However chrome in the pure state, as silicon and magnesium was not subjected to separation.

It was noticed that cobalt turned not into pure iron, but into a cluster (silicon and magnesium ion combination) at hydrogen atom detaching. We called it as iron izostere, since its spectral lines coincided with spectral lines of iron, magnesium and silicon. The iron clusters will easily be converted into krypton clusters (or krypton izostere) at chrome ions available according to the schema:

$$Js^{36} = Cr^{24} + Mg^{12} + W. \qquad (5)$$

But, as the formed chrome is the ion cluster and magnesium atom, the dual krypton cluster is formed of 3 chrome clusters.

$$\left(Js^{36}\right)_2 = \left(Cr^{24}\right)_3 . \quad (6)$$

Thus, a superconducting element is not the other element, as krypton cluster, at which a gaseous component is metallized (O, F, Ar, Kr, Xe, Rn). In this connection the vikaloy alloy can be expressed by a formula conformity:

$$Co_{5.1} + V_{1.1} + Fe_{3.7} = Kr_{7.2} + W \quad (7)$$

that corresponds to:

$$51Co^{27}_{59} + 11V^{23}_{51} + 37Fe^{26}_{56} = 36\left(Js^{36}_{78}\right)_2 + 26n^0 + W. \quad (8)$$

Here 26 neutrons will be arranged among krypton clusters in such a way, that the neutron release will be insignificantly small at vikaloy fusion. Though the krypton clusters are tighter, than separately Co, V, Fe, so the energy W will be positive. The superconductivity of krypton clusters at room temperature is defined according to huge diamagnetism of isolated domains mixed with paramagnetic domains of iron and cobalt. There is cobalt 0.4%, tungsten 6%, iron 93.6% in a tungsten magnet (H_C = 5200 A/m, B = 1.05 Tl). Though superconducting domains are formed by krypton clusters in such magnet, so their calculation in combination will be:

$$Co_{0.4} + W_6 + Fe_{93.6} = Kr_{79.8} + W \quad (9)$$

or

$$4\left(Co^{27}_{59}\right) + 60W^{74}_{184} + 936Fe^{26}_{56} = \\ = 399\left(Js^{36}_{78}\right)_2 + 1112n^0 + W. \quad (10)$$

Here neutrons will be arranged among krypton clusters. The receivable alloy has hexagonal structure (crystalline). Hence, the hexahedron construction goes from cobalt germ, surrounded by five tungsten atoms on the first stratum and fourteen tungsten atoms on the second one (see the magic numbers of the Tab. 1 [2]. Apparently, on the ninth stratum, from which iron atoms occupy seven ones, the elementary crystal-cluster growth ends. Then we notice from the table 1, that the following is involved on the ninth stratum: one cobalt atom, 19 tungsten and 265 iron atoms. Hence, the formula (10) should be written down correctly as:

$$4\left(Co^{27}_{59}\right) + 76W^{74}_{184} + 1060Fe^{26}_{56} = \\ = 458\left(Js^{36}_{78}\right)_2 + 300n^0 + W. \quad (11)$$

or

$$Co^{27}_{59} + 19W^{74}_{184} + 265Fe^{26}_{56} = 229Js^{36}_{78} + 75n^0 + W. \quad (12)$$

Hence, the percentage of vikaloy alloy should be: Co — 0.35%, W — 6.66%, Fe — 92.99%. And it is true, this small correction increases the magnetic field energy almost twice.

Now some words about cluster superconductivity. Gases, as we know, are not electrically conductive, but they become electrically conductive at a breakdown. The higher gas compression ratio is, the higher channel electrical conductivity is. If gas was in liquid state, so the electrical conductivity of the breakdown channel increased in hundred thousand times. Naturally, the gas metallization makes it superconductive in general. Now, let's pay attention to platinum, so it will form crystalline clusters with cobalt in nuclear reactions as well (chrome and xenon gas combinations).

$$Pt^{78} = Cr^{24} + Xe^{54}. \quad (13)$$

Almost all lanthanoids have cluster properties including lanthanum itself. Really, for example, we have a cluster for lanthanum

$$La^{57} \cong Js^{57} = Li^3 + Xe^{54}. \quad (14)$$

If to pay attention to an alloy $SmCo_5$, it will be converted into the cluster combination $LaNi_5$ in the beginning, and then into the cluster combination Ni_5XeLi according to the schema:

$$SmCo_5 \Rightarrow Sm^{62} + 5Co^{27} = \\ = La^{57} + 5Ni + W \Rightarrow LiXeNi_5 . \quad (15)$$

As nickel itself is represented by neon and argon combination $Ni = NeAr$, so, finally, the alloy $SmCo_5$, will be presented by the cluster $LiXeNe_5Ar_5$, then $SmCo_5 = LiNe_5Ar_8$.

Samarium — the cobalt alloy — has hexagonal crystalline structure. A germ of a superconducting cluster, as the previous transformation shows, is lithium. It is clipped by five neon atoms and eight argon atoms in a hexahedron (the magic number is 14, corresponding to atoms number in a cluster crystal suits only by hexahedral and pyramidal (pramyn-4) crystals). As the cluster is developed of lithium metal nucleus, obviously, the crystalline structure of a superconducting cluster $SmCo_5$ has either hexagonal, or pyramidal habitus.

We always discover ferromagnetism development with cluster formation of metals and inert gases. Only gases are given here as nuclear nucleus combinations of other dense elements, for example, chrome, which is represented as:

$$Cr^{24} = 6Be^4 = 3O^8 = Ar^{18}C^6; \quad (16)$$

$$\left(Cr^{24}\right)_3 = \left(Kr^{36}\right)_2 . \quad (17)$$

Let's analyze this statement on the alloy example of $CdSe$:

$$Cd^{48}_{112} + Se^{34}_{76} = Ag^{47}_{109-111} + Br^{35}_{77-79} + W_1 =$$

$$= Pd^{46}_{108-114} + Kr^{36}_{72-84} + W_2. \qquad (18)$$

Here $W_1 = W_{Cd} + W_{Se} - W_{Pd} - W_{Kr} = 33.29 + 19.856 - 31.799 - 23.436 = 2.1$ MeV; $W_2 = W_{Cd} + W_{Se} - W_{Pd} - W_{Kr} = 33.29 + 19.856 - 30.435 - 18.176 = 4.5$ MeV.

The formed krypton does not release as gas in the reaction (18), and represents metallic krypton modification. Palladium is presented also as inert gases combination ($Pd = NeKr = NeAr_2 = NiAr = CrTi$). Therefore both selenium and cadmium can be the basis for making ferromagnetic alloys. For example, the exchange reaction by alpha-particles goes between quicksilver and selenium in a known ferromagnetic $HgCrSe_4$ according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow} Hg^{80}_{202} + 4Se^{34}_{78} = Hf^{72}_{186} + 4Kr^{36}_{82} + W. \qquad (19)$$

But hafnium is divided into

$$Hf^{72} = Xe^{54} + Ar^{18} = Kr^{36} + 2Ar^{18} = 4Ar^{18}. \qquad (20)$$

Hence, the clusters will be formed on the chrome basis in chrome environment, which is argon carbide (18) itself. Let's remark, that a lot of investigations are devoted to the problems of cluster combinations (see, for example, [26]). However, the cluster analysis in melts at a pseudo-nuclear level has not been solved yet.

We discover the inert gases clusters and ions of periodic system elements all the same (as a rule, metals and in melts) nevertheless a new ferromagnetic, even without applying iron, nickel, cobalt and gadolinium would be obtained. For example, let's consider the ferromagnetics, obtained in alloys: EuS, $PbMn_6O_{10}$, Cr_2O_3. The first combination EuS or Eu_2S_3 will be converted easily to sulfides of samarium and gadolinium according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow} Eu_2S_2 \Rightarrow \overset{\nearrow\ H_{1-3}\ \searrow}{Eu^{63} + Eu^{63}} + S_2^{16} =$$

$$= Sm^{62} + Gd^{64} + S_2^{16} + W. \qquad (21)$$

Gadolinium is ferromagnetic, since it compounds the cluster combination of inert gases:

$$Gd = NeXe = NeArKr = NeAr_3. \qquad (22)$$

The second combination forms inert gases at the expense of hydrogen atoms and alpha particles transferring from a lead nucleus. The approximate reaction goes according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow} Pb^{82} + 6Mn^{25} + 10\,O^8 =$$

$$= Ba^{56} + 6Fe^{26} + 10Ne^{10} + W \rightarrow 10\alpha - - \rightarrow \qquad (23)$$

The barium, as well as alkaline elements such as strontium or calcium, is divided into combinations:

$$Ba = SrAr = CaKr = HeXe. \qquad (24)$$

The third combination $Cr_2O_3 = 2Kr$ is the krypton cluster itself. Apparently, the antiferromagnetism of the combination Cr_2O_3 is characterized also by it.

It can be noticed analyzing the reactions, in which the crystalline clusters on the inert metallized gases are formed, that despite of gaseous component formation (let it be metallic one), the matters acquire a superconductivity — the property, probably, missing at ordinary temperatures. The superconductivity is not a phenomenon of low temperatures only, the superconductivity exists at any temperature. Only this phenomenon is hidden by the phenomenon of ordinary electric conductivity. The matters (for example inert gases) have two laws of electric conductivity:

— electric conductivity before rapture (ECBR);

— electric conductivity after rapture (ECAR).

As it is known, these conductivities differ in 6-10 orders. Though ECAR acquire a superconductivity with the matter metallization approaching — is not something new, but gases have the ECBR and ECAR performances. In particular, all fluids (water, kerosene, alcohol etc.), all insulators (resins, porcelain, glass, ceramics), semiconductors (Si, Ge, $GaSb$, $JnAS$, $JnSb$ etc.), oxides, sulfides, halides, salts etc. have them as well. The most interesting, that ECAR was detected in metals (for example, tin, quicksilver, lead, zinc, palladium, hafnium).

The cluster combinations of metals and inert metallized gases, on one hand, behave as gaseous elements, and on the other hand, — as superconductors. We called the metallized gaseous krypton superconductor as kameron (in short from the surname of a Holland scientist Kamerling Onnes) and such element is designated as $\mathring{\mathrm{Kr}}^{36}$ (a small circle above the sign Kr means the name Onnes). We suppose, that kameron has octahedral habitus and is represented by four fluorine atoms and two deuteron atoms. Kameron is chemically inertial, however, kameron ionization potentials coincide with deuteron ionization potentials (about $\pm$ 12 eV). If kameron is in an alloy with similar octahedral clusters of alkaline metals (Dt_2Li_4, Dt_2Na_4, Dt_2K_4, Dt_2Cu_4, Dt_2Rb_4, Dt_2Ag_4 etc.), so the cubical superconducting clusters will be formed. Thus we discover, that the octahedral clusters of kameron and metallic octahedral clusters of alkaline elements ensure their tight connection with each other, forming any extended connection.

Here it can be noticed as well, that the metal — gas clusters characterize not only ferromagnetism, superconductivity, but also any kinds of semi-conductivity and controllable conductivity in general. Really, if, for example, copper can be sated with deuterium and partially with tritium and current can be passed through it

(the density up to $2 \cdot 10^6$ A/ mm^2 and duration about 0.1-1 sec), so tritium and partially deuterium will begin to divide into pieces, if there is small firing neutron background. Hydrogen atoms will be torn from copper nucleus as a result of these reactions, which adhering to other nucleus will form nickel and zinc according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow} \overset{\nearrow H_{1-3} \searrow}{Cu^{29}_{63} + Cu^{29}_{63}} = Ni^{28}_{60-62} + Zn^{30}_{64-66} + W. \qquad (25)$$

Here $W = 2W_{Cu} - W_{Ni} - W_{Zn} = 2 \cdot 18.986 - 17.129 - 20.07 = 0.733$ MeV.

If copper is presented as the oxide Cu_2O, so the cluster Ni_2Ne can be formed according to the schema:

$$i \Rightarrow \overset{\nearrow H_{1-3} \searrow}{2Cu^{29}_{63} + O^8_{16}} = 2Ni^{28}_{60-62} + Ne^{10}_{18-22} + W. \quad (26)$$

In this case a nickel — neon cluster has different rapture conduction depending on EMF direction. There's the complete analogy to the discharge schema with needle-flat welding rods. Therefore, if the oxygen atoms are oriented in relation to copper welding rods and matter inert oxygen, so the elementary rectifier or bipolar superconductor will be realized.

Copper oxide rectifiers are the first bipolar superconductors, which became a basis of a modern high-thermal superconductivity. It can be supposed having understood the physical sense of a bipolar metal — gas cluster in a role of a superconductor, that the similar bipolar superconductivity is proper to all oxides formed in the orientation of a metal — oxide superconductor. Precisely it will be true in clusters such as metal — sulfur, metal — selenium, metal — tellurium, metal — ytterbium etc. But if to consider the oxidants of an oxygen series, except of oxygen, sulfur, selenium and tellurium, iron (for example, the combination Fe_3C, Fe_3Zn characterizes iron as oxidant), ruthenium, samarium, ytterbium, quicksilver, radium, californium are referred to them according to the table 2 as well [2].

Here we notice an iron role in the bipolar superconductor formation once again, as a role of samarium above mentioned. As it concerns silicon and germanium, they behave similarly to metal-gas clusters and also have a bipolar rapture conductivity.

The high-thermal superconductivity at liquid nitrogen temperature in germanium semiconductors was obtained by the authors in 1960 [15]. The essence of a semiconductor superconductivity is based on space separation of atomic welding rods (for example, indium and phosphorus). Indium is just soldered into germanium, and phosphorus is input as an impurity. As germanium is a cluster $Ge = SiAr = BFAr = CoB = H_2Ne_3$, so the rapture conductivity will be formed between a common body of germanium and indium, as between a cloud and lightning rod, naturally, the conduction polarity will have great value in semiconductors. Thus the nuclear nature of hydrogen atoms transferring occurs apparently according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow} \overset{\nearrow H_{1-3} \searrow}{\left(Jn^{49}_{115}\right)_2 + Ge^{32}_{72}} = \left(Cd^{48}_{112-114}\right)_2 + Se^{34}_{74-78} =$$

$$= Cd^{48}_{108-114} + Pd^{46}_{108-110} + Kr^{36}_{78-82} + W. \quad (27)$$

Partially hydrogen atoms from indium nucleus are thrown onto phosphorus atoms, which is usually input into germanium. Then current will go for one polarity according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow} \overset{\nearrow H_{1-3} \searrow}{Jn^{49}_{115} + P^{15}_{31}} = \overset{\nearrow \alpha \searrow}{Cd^{48}_{112-114} + S^{16}_{32-34}} + W_1 =$$

$$= Pd^{46}_{108-110} + Ar^{18}_{36-38} + W_2; \qquad (28)$$

$$\overset{i\Rightarrow}{n^0\Rightarrow} \overset{\nearrow H_{1-3} \searrow}{P^{15}_{31} + Jn^{49}_{115}} = Si^{14}_{28-30} + Sn^{50}_{116-118} + W_3. \quad (29)$$

These two reactions demonstrate that the hydrogen atom translation is asymmetric. The system electrical conductivity ($Jn - P$) in germanium medium is asymmetric also. Germanium, as well as silicon, has octahedral crystals, so the superconducting clusters can exist in them as well. The similar asymmetry in electrical conductivity is observed in selenium rectifiers as well, when ipolar clusters are formed at the expense of hydrogen atoms or alpha particles translation.

Valve cluster properties of metal — gas or metal — metalloid (for example, the lead sulfide) result in cluster strata formation. Really, the valve properties formation occur in the same selenium rectifier under currents operating and does not so quick, but step-by-step, as at electrolysis, while all hydrogen atoms and the alpha particles will not take up the stratum above a selenium surface. The same formation can occur at a nuclear level as well, when low-speed neutrons affect upon nucleus together with electric currents (for example, fragments of deuterium and tritium disintegration). The phenomenon of metal — gas clusters current formation in laminated metals is one of the major phenomena in pseudo-nuclear power engineering.

However, if the energy nature of valve property can be taken into account, so the asymmetrical energy release can exhaust a nuclear resource and the valve properties can reduce step-by-step. For example, the lead sulfide will be converted into cluster combination of quicksilver and argon under currents and neutrons operating according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow} \overset{\nearrow H_{1-3} \searrow}{Pb^{82} + S^{16}} = Hg^{80} + Ar^{18} + W. \qquad (30)$$

Here the energy W is released as photons.

If the valve elements from gallium or indium arsenide as well as gallium or indium surmynide are used, so it appears the hydrogen regulation in them results in photon radiating in visible spectrum area. Here the reactions go according to the schemas:

$$\underset{n^0\Rightarrow}{\overset{i\Rightarrow}{\overset{\nearrow H_{1-3}\searrow}{As^{33}}}} + Ga^{31} = 2Ge^{32} + W_1; \quad (31)$$

$$\underset{n^0\Rightarrow}{\overset{i\Rightarrow}{\overset{\nearrow H_{1-3}\searrow}{Jn^{49}}}} + As^{33} = Cd^{48} + Se^{34} + W_2; \quad (32)$$

$$\underset{n^0\Rightarrow}{\overset{i\Rightarrow}{\overset{\nearrow H_{1-3}\searrow}{Sb^{51}}}} + Ga^{31} = Sn^{50} + Ge^{32} + W_3; \quad (33)$$

$$\underset{n^0\Rightarrow}{\overset{i\Rightarrow}{\overset{\nearrow H_{1-3}\searrow}{Sb^{51}}}} + Jn^{49} = 2Sn^{50} + W_4. \quad (34)$$

Naturally, the hydrogen atoms can be directed in the reverse order as well, because they depend on a current direction in a major extent, instead of neutron stimulation intensity. Here it can be recollected that the similar processes are made at hard ferromagnetic magnetizing along the ideal curve. As we know, it is possible to pass to the ideal magnetization curve, if the smaller constant field in several times will be overlapped on major splashes of a variable field. The modern methods of magnetic record use the ideal magnetization curve.

The pseudo-nuclear reactions are based on joint action of rather weak energy direct currents (up to $10^{6\ldots7}$ A/mm^2), acting simultaneously with the stress neutron phenomena, the energy of which is more in some times. The hydrogen atoms directional move along the ideal curves means it as well.

Metal — gas clusters are preferred at the formation of magnets and superconductors, for example, barium oxide (BaO), the strong magnets are sintered of it, in which the cluster combination BaO will be converted in $XeNe$ according to the schema:

$$\underset{n^0\Rightarrow}{\overset{i\Rightarrow}{\overset{\nearrow H_{1-3}\searrow}{Ba^{56}_{136}}}} + O^8_{16} = Xe^{54}_{132} + Ne^{10}_{20} + W. \quad (35)$$

Here both xenon and neon are metals. Therefore, if any metal will be input into a BaO melt, so it is possible to detect metal — gas clusters having superconducting properties. Here the energy W is released as photons and electrons, since the density of formed clusters is rather great.

We will usually use the combination $Ba\,(NO_3)\,Fe_2O_3$ and blend it according to the formula $BaOFe_2O_3$ at hard ferrites manufacture. Thus the coercive force (H_C) is obtained about 960 A/cm, the induction In — 1.023 Tl, the Curie point $O_K\,^0C \approx 405$ - $450\,^0$C. Actually the superconducting domains (clusters) can exist up to $450\,^0$C. Other ferrites on the formula basis $MeFe_2O_4$ (for example, $MnFe_2O_4$ — manganese ferrite, $NiFe_2O_4$ — nickel ferrite, $FeFe_2O_4$ or Fe_3O_4 — magnetite) have smaller Curie point and smaller coercive force ($H_C = 0.32 - 4.8$ A/cm, $B_S = 0.04 - 0.5$ Tl, $B_r = 0.02 - 0.3$ Tl), if zinc, manganese or lithium are taken as Me.

In metal alloys (for example, alnisi 33% Ni, 13-14% Al, 1% Si, the rest — Fe, $H_C = 517.5$ A/cm, $B_r = 0.4$ Tl; alnico 17- 18% Ni, 10% Al, 1% Co, 6% Cu, the rest — Fe, $H_C = 400$ A/cm, $B_r = 0.74$ Tl, magniko 11-15% Ni, 8-10% Al, 20-25% Co, the rest — Fe, $H_C = 480 - 560$ A/cm, $B_r = 1.2 - 1.35$ Tl). The stability of superconducting clusters is great especially because of iron oxidant applying, since it is in the same series, where oxygen is as well (see Tab. 2 [2]).

Naturally, other members of this series, i.e. ruthenium Ru_{44}, samarium Sm_{62}, quicksilver Hg_{80}, californium Cf_{98} allow to obtain superconducting clusters even more strongly both for making superstrong constant magnets as well as superresistant superconductors. The iron Curie point is equal to $770\,^0$C, cobalt Curie point is equal to $1120\,^0$C, nickel Curie point is equal to $358\,^0$C. However, the mixtures of these and other alloys can change the Curie point greatly. For example, if to enter 30% of nickel into iron, so the Curie temperature drops from $770\,^0$C to $100\,^0$C. The alloy melting point reduces almost twice together with it as well. About 6.5% Si introducing into iron increases the magnetic conductivity in four times (from 5.5 to 28). Silicon decreases the melt temperature $Fe + Si$ also and softens it essentially, since the hydrogen atom transferring from iron nucleus to silicon is observed according to the schema:

$$\underset{n^0\Rightarrow}{\overset{i\Rightarrow}{\overset{\nearrow H_{1-3}\searrow}{Fe^{26}_{56}}}} + Si^{14}_{28} = Mn^{25}_{53-55} + P^{15}_{29-31} + W. \quad (36)$$

Manganese is subjected to nuclear transformations itself easily, as well as nitrogen. So, for example, manganese can be divided into chrome and iron at weakened neutrons and currents operating according to the schema:

$$\underset{n^0\Rightarrow}{\overset{i\Rightarrow}{\overset{\nearrow H_{1-3}\searrow}{Mn^{25}}}} + Mn^{25} = Cr^{24} + Fe^{26} + W. \quad (37)$$

Here $W = 2W_{Zn} - W_{Cr} - W_{Fe} = 2 \cdot 16.21 - 14.335 - 15.707 = 2.378$ MeV.

Nickel with chrome exchange with hydrogen atoms as well, as well as alpha particles, for example:

$$\underset{n^0\Rightarrow}{\overset{i\Rightarrow}{\overset{\nearrow H_{1-3}\searrow}{Ni^{28}_{58}}}} + Cr^{24}_{52} = 2Fe^{26}_{54-56} + W. \quad (38)$$

Here $W = W_{Ni} + W_{Cr} - 2W_{Fe} = 19.123 + 14.335 - 2 \cdot 15.707 = 2.044$ MeV.

It is proved experimentally, that nickel-chrome wire releases thermal energy more than pure iron at same expenditure electric power in an abnormal condition of its heat-up. Especially electric current reconstruct is characteristic in zirconium oxide. For example, the zirconium oxide has monoclinic structure at room temperature, it exchanges it into tetragonal at higher temperature than 1250^0 C. It turns into hexagonal structure at the temperature about 1900^0 C, and into cubical one at 2300^0 C. It is clear: that we deal with ordinary cluster rearrangement at the expense of hydrogen atoms transferring according to the schema:

$$\overset{i\Rightarrow}{n^0\Rightarrow} Zn^{40} \overset{\nearrow 2\alpha \searrow}{+} 2O^8 = Kr^{36} \overset{\nearrow 2\alpha \searrow}{+} 2Ne^{10} + W_1 =$$

$$= Ge^{32} + 2Mg^{12} + W_2 = Ni^{28} + 2Si^{14} + W_3. \quad (39)$$

Nickel and silicon formed really have cubical structure and occur at the temperature above 2300^0 C. Zirconium oxide forms metallized Kr^{36} and Ne^{10} also, which can form superconducting clusters with metals (for example, with copper, silver, gold). Similar reactions are observed in aluminum oxide Al_2O_3. So, in particular, superconducting porcelain ceramics was detected recently. It gives a foundation to aluminum role understanding at forming strong magnets (for example, alnico).

4. Conclusion

The theoretically predicted and experimentally obtained phenomenon of ferromagnetic matters nuclear transformation has made radical changes to the existing imagination about solids nature and properties at major induction currents passing through them. The discovery represents the large contribution into a modern solid physics. It has served as the beginning of intensive investigations of a new trend in physics — in nuclear reactions physics of cold synthesis.

The further phenomena investigation and looking up cold synthesis reactions according to the theory predictions, and it is possible, for example, for light impurities (hydrogen, lithium, boron, nitrogen, oxygen, fluorine, sodium, aluminum, aeon etc.) opens out a wide outlook of investigation results for problem solving of practical nature. The applied discovery value is in those, that it is possible making the new methods in principle of ferromagnetic matters, superconductors, nuclear energy sources and matter obtained on its basis.

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A SIMPLE COSMOLOGICAL MODEL WITH DECREASING LIGHT SPEED

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An alternative model describing the dynamics of a flat Universe without cosmological constant and allowing a gradual change of c with time is proposed. New relationships of redshift vs. distance and cosmic background radiation temperature are given. Values for the Universal radius, matter density, Hubble parameter, light deceleration, cosmic age and recombination time are obtained. Distant SNeIa faintness is explained within this decelerating, matter-dominated Universe without invoking dark energy. Horizon, flatness and other problems of standard Big Bang cosmology are solved without the need of inflation. The top speed of any signal, force, particle or wave at any time is linked to the expansion speed of the Universe itself.

1. Introduction

In recent years the possibility of non-standard cosmologies with varying light speed has been explored in order to solve cosmological issues such as the horizon, flatness, large scale homogeneity, initial fine-tuning or cosmological constant problems, among others (Ellis, 2000) as an alternative to the inflationary model. These theories have been recently reviewed (Magueijo, 2003) and its compatibility with the second law of thermodynamics has been studied (Youm, 2002). First attempts were from Moffat (1993). Albrecht and Magueijo (1999) postulated unchanged Friedmann equations and got a term proportional to c'/c, where c' denotes the time derivative of c, the speed of light in vacuum. In those theories c undergoes a sudden change, from speeds many orders of magnitude larger than the present value (c_0) in a phase transition of the very early Universe, so that the initial value problems are avoided. Barrow (1999) extended these ideas to scenarios in which both c and G were proportional to some power of the scale factor. Clayton and Moffat (1998) implemented another varying speed of light model by considering a bimetric theory of gravitation in which one metric describes the standard gravitational vacuum and a second one describes the geometry in which matter is propagating. Moffat (2001, 2002, 2003) has discussed some cosmological implications of his different models. Usually in these works the period of variation of c is confined to the early Universe, the cosmological constant remains in the equations, some new parameters with non specified values are used and fitting of each theory with astrophysical observations is not discussed.

On the other hand, it has been theoretically shown how the speed of low-energy photons could be higher than c, depending on the energy density of modified vacua (Latorre et al. 1995). Kiritsis (1999) concluded that when a test brane moves in a black hole bulk spacetime, c varies as the distance from the brane to the black hole. Alexander (2000) generalised this model by including rotation and expansion of the bulk so that c gets stabilised at long times.

In this paper a concrete model with smoothly decreasing light speed is presented. This model yields exact solutions for cosmological dynamics and avoids the use of free parameters or free functions to fit the observations. The model needs no phase transitions nor cosmological constant. In section 2 the fundamental assumptions and postulates are developed into some simple equations. In section 3 the redshift-distance relationship is revised and quantitative results from our model are compared with observational data. In section 4 the present light deceleration value is obtained. In section 5 Jordan's adimensional numbers are discussed in light of the present model. Section 6 shows that flatness and the horizon problems can be avoided without inflation. Finally, in section 7 a new relationship between cosmic background radiation temperature and redshift, which can be used to test the present model, is given.

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2. Fundamentals

Through this work, the specific time t has been chosen to be the comoving proper time. Speed of light depends on time, but not on the position or the velocity of the observer. The Universe is assumed to be spatially homogeneous and isotropic and practical flatness of space is also assumed.

It is remarkable that the farthest observable events, including high redshift galaxies and photons from cosmic background radiation (CBR), originated at distances close to ca. 15 billion light-years, the estimated Hubble radius of the Universe (R_0). In other words, we can reach practically the entire history of the Universe by observing very distant events (except for the first ca. 300,000 years when it was opaque). This could seem obvious, but consider for a moment an Universe expanding 10 times more slowly than ours: then the most distant objects would be "only" about 1.5 billion light-years away. On the other hand, if the Universe had expanded 10 times faster than it does, then most quasars, distant galaxies and CBR would be out of our event horizon. Therefore it seems that the maximum expansion speed, which is reflected by the Hubble parameter (H_0), is similar to the speed of light today (c_0):

$$H_0 = \frac{R_0'}{R_0} \approx \frac{c_0}{R_0}, \tag{1}$$

where R_0' is the time derivative of R_0. Then R_0', the actual speed of universal expansion, is approximately c_0. Let's look at this point in a different way. Consider first $c_0 > R_0'$, then photons could escape from the Universe, which does not happen. Another possibility is $c_0 < R_0'$, but then two objects very far away in the Universe could recede from each other faster than c_0, which has never been observed and would violate special relativity. Furthermore, if the entire Universe is causally interconnected then its maximum expansion rate nowadays must be c_0 (see discussion on the horizon problem below). Therefore we assume $c_0 = R_0'$, i.e. this expansion speed practically matches the speed at which the event horizon recedes from us. In more general terms, for different moments of the Universe history we have:

$$R' = c. \tag{2}$$

This generalisation is justified because the above arguments should be valid in any cosmic time and, on the other hand, it would be much too coincidence if equation 1 only holds for the present Universe. An equivalent equation was already noticed by Pascual Jordan decades ago as will be discussed in section 5.

From (2) it is immediate that:

$$\frac{R'}{R} = H = \frac{c}{R}. \tag{3}$$

From the field equations of general relativity (GR), the critical density of the Universe reads:

$$\rho c = \frac{3H^2}{8\pi G} = \frac{3c^2}{8\pi G R^2}. \tag{4}$$

On the other hand, an Universe of total gravitational mass M with spherical symmetry would have a density:

$$\rho = \frac{3M}{4\pi R^3}. \tag{5}$$

Then, for an Universe with critical density we obtain from (4) and (5):

$$1 = \frac{Rc^2}{2GM}, \tag{6}$$

which agrees with the classical Schwarzschild solution for GR describing a spherical black hole. So, the empirical observation of a universal density of matter close to the predicted for a black hole of radius R_0 (Singh, 1974; Sidharth, 2000; Casado, 2002) would not be a mere coincidence for present-day Universe, but a prediction of this model for practically any cosmic time. Therefore, in a flat Universe that follows (2), if R grows, then c decreases; i.e. as this Universe expands, c should decrease, so that both terms in equation

$$2GM = Rc^2 \tag{7}$$

will remain constant (assuming that the gravitational constant G and the universal mass M **are real constants**). In other words: Could a static equation like (7) hold for an expanding Universe? The answer is yes only if c is continuously decreasing.

In spite of the existing literature on varying speed of light theories, this heterodox postulate should be further justified. Einstein himself disclaimed a unlimited validity of c as an universal constant, even if this was a postulate of special relativity. In his own words (Einstein, 1920): *"...according to the general theory of relativity, the law of the constancy of the velocity of light in vacuo, which constitutes one of the two assumptions in the special theory of relativity and to which we have already frequently referred, cannot claim any unlimited validity. A curvature of rays of light can only take place when the velocity of propagation of light varies with position."*

It also has to be stressed that the present model includes the "weak equivalence principle" stating that the trajectory of any freely falling body or particle does not depend on its internal structure, mass or composition. Furthermore, our model also respects the local Lorentz invariance. It only disagrees with the stronger or "Einstein equivalence principle" in that any non-gravitational experiment may not be independent of **when** it is performed.

At which rate would c decrease? To solve this question we have to introduce an equation relating R and t. The simplest one derives from classical gravitation which is a good approximation if our Universe is practically flat, as all the observations seem to indicate. In an Universe being spatially flat ($k = 0, \Omega = 1$), matter-dominated ($p \approx 0$, see section 7) and without cosmological constant (Λ=0), the Friedmann equations agree with classical gravitation. This was also the case in the Einstein-De Sitter cosmology.

By Newton laws divided per mass of test particle:

$$R'' = \frac{-GM}{R^2}, \tag{8}$$

where R'' denotes the second derivative of R vs. t, i.e. the gravitational deceleration of Universal expansion.

Now, combining (2) and (8):

$$R'' = \frac{dc}{dt} = \frac{-GM}{R^2}. \tag{9}$$

Substituting R by its expression from (7) we have:

$$\frac{dc}{dt} = \frac{-GMc^4}{4G^2M^2} = \frac{-c^4}{4GM}; \tag{10}$$

$$-\frac{dc}{c^4} = \frac{dt}{4GM}, \tag{11}$$

and integrating we obtain:

$$\frac{1}{3c^3} = \frac{t}{4GM} \tag{12}$$

so that:

$$c^3 = \frac{4GM}{3t}. \tag{13}$$

Then, substituting back R instead of its expression from (7), we get:

$$c = \frac{4GM}{3c^2t} = \frac{2R}{3t}, \tag{14}$$

and thus:

$$R = \frac{3ct}{2}. \tag{15}$$

Now it is immediate to deduce

$$R^3 = \frac{9GMt^2}{2}. \tag{16}$$

These simple expressions relate R, c and t, but we still can not obtain c', unless we determine R or t independently. We address this issue by derivation from empirical values of redshift (z) and distances in the next section.

3. Redshift-distance relationship

Modern astrophysics attributes the cosmological redshift to the stretching of wavelengths of photons as they propagate in an expanding Universe:

$$z = (\lambda_0/\lambda) - 1 = (R_0/R) - 1. \tag{17}$$

So, that z values depend essentially on the scale factor R_0/R (i.e. the ratio of Universe sizes when the light was received and emitted) and do not imply any specific velocity of expansion, opposite to classical Doppler interpretation. That opens the possibility of having a parameter H_0 different of nowadays accepted values.

Within our model the cosmological redshift is basically gravitational and is observed as a decrease of photons frequency as light travels against the Universal gravitational field when going from the past, more dense Universe, to the present one, just as any other particle losses energy during the expansion. It has to be noticed that only the observable Universe has effects, such as forces, on us, and the observable Universe belongs to the past, so that we are feeling gravitational forces coming from the past in the same way we are receiving light from past events, given that speed of gravity propagation is also c (see section 6). This redshift is also defined as usually:

$$z = (\nu - \nu_0)/\nu, \tag{18}$$

where ν= c/λ. Since $\lambda \propto R$ and, according to (7), $c \propto R^{-1/2}$, ν should be proportional to $R^{-3/2}$. Then:

$$z = \frac{R^{-3/2} - R_0^{-3/2}}{R_0^{-3/2}} = \left(\frac{R_0}{R}\right)^{3/2} - 1 \tag{19}$$

a relationship different to conventional Eq. (4.). Making $R_0 - R \approx r$, the observed distance to a certain object, and rearranging we can linealize (19) to:

$$f(z) = 1 - (z+1)^{-2/3} \approx r/R_0. \tag{20}$$

When $f(z)$ is plotted vs. distance (Tully,1988) one obtains a good straight line ($R^2 = 0.996$) up to distances over 7 billion of (conventional) light-years with intersection of the axis close to the origin (Fig. 1).

The slope of that line is $1/R_0$ and the resulting value for R_0 is close to $2.0 \cdot 10^{26}$ m, a factor 3/2 bigger than the value predicted by the standard theory (Weinberg, 1972).

Our model predicts -without need of introducing an "ad hoc" repulsive dark energy to accelerate Hubble expansion- that supernovae with z $\sim$ 1 are farther away than previously expected, so that they will appear fainter, as recently observed (Riess et al., 1998, 2001). Within our model an object showing $z = 1$ would be observed at a distance of $7.4 \cdot 10^{25}$ m, while within the standard model it would be at $6.6 \cdot 10^{25}$ m. This

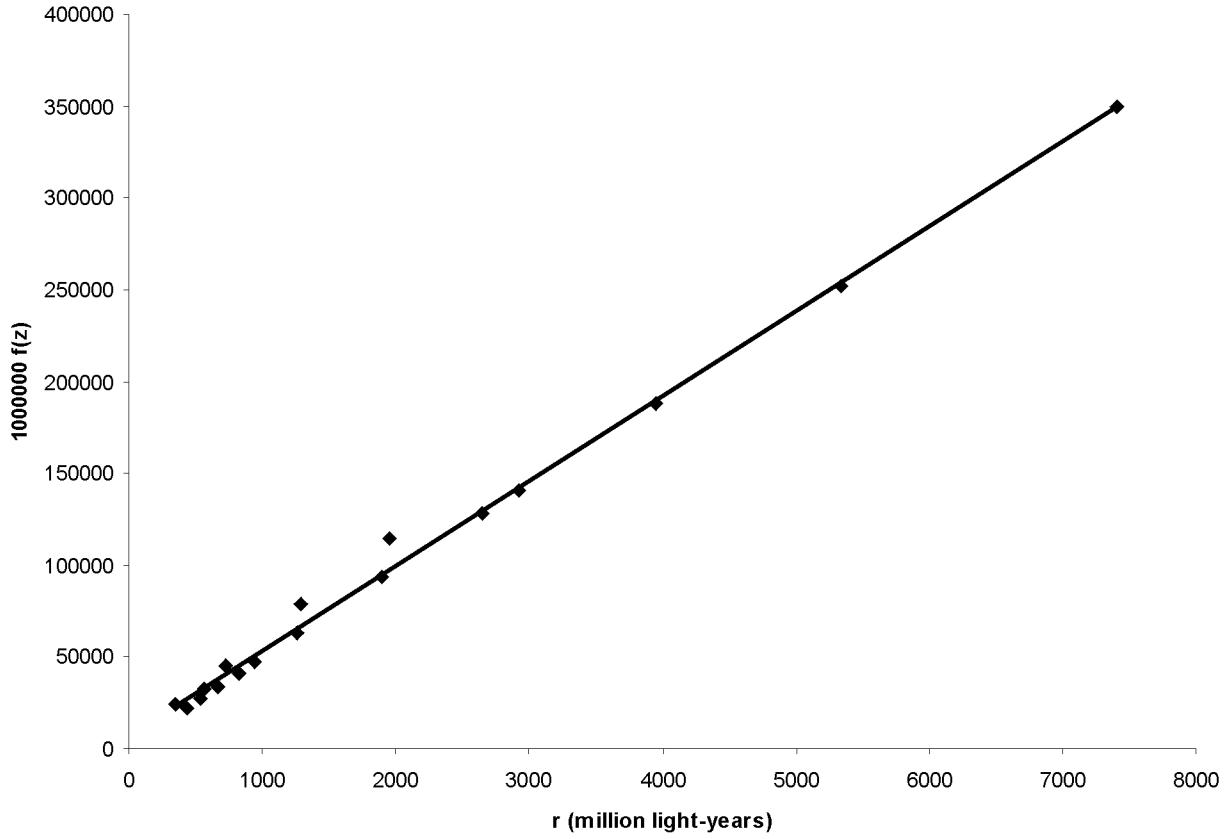

Figure 1: The function $f(z)$ of equation (4.) vs. distance r for 17 galaxies and quasars. The Y scale has been conveniently expanded by a factor 10^6.

difference actually leads to about 25% less apparent luminosity than previously expected. Our hypothesis can be tested through further SNeIa data at different redshifts. If true, the cosmic expansion might not be accelerating after all.

Now we can apply equation (4.) to obtain, for the present Universe:

$$t_0 = \frac{2R_0}{3c_0} = 4.5 \cdot 10^{17} s = 1.4 \cdot 10^{10} \text{ years}, \qquad (21)$$

very close to the accepted value, but obtained in a different way.

With this quantitative results we can easily obtain the present matter density by calculating the Hubble parameter from:

$$H_0 = \frac{c_0}{R_0} = \frac{2}{3t_0} = 1.5 \cdot 10^{-18} \text{ s}^{-1} \qquad (22)$$

and substituting it on equation (4). The result is $\rho_m \approx 4 \cdot 10^{-30}$ g/cm^3. This value is different to the conventional critical density, but agrees quantitatively with the matter density in standard model with $\Omega_m \approx 0.4$. According to our model, the present matter density equals the corrected critical density obtained from the value of the Hubble parameter in (21).There is no room for $\Omega\Lambda$. In connection with this, let us recall that H_0 is a crucial cosmological parameter that, however, has been very poorly determined, with values that had varied historically as much as one order of magnitude. The value in Eq. (21) is close to the lowest experimental determinations obtained (ca. 50 km s^{-1} Mpc^{-1} $= 1.6 \cdot 10^{-18}$ s^{-1}), but significantly lower than the currently accepted values (ca. 70 km s^{-1} Mpc^{-1} $= 2.3 \cdot 10^{-18}$ s^{-1}).

Notice that equation $H = 2/(3t)$ is in agreement with the Einstein-De Sitter model, but now the figures are different. The accepted values of H_0 would lead, within that model, to an Universe of less than 10 billion years, younger than the oldest stars and globular clusters (with more than 12 billion years). This oldness problem contributed to discard the Einstein-De Sitter cosmology. The present model solves this problem given the lower values of H_0. Equation (21) can also be generalised to other moments in the cosmic history.

4. Present value of light deceleration

Finally, from the radius, the density and equation (9) is now easy to obtain the present value of light deceleration, which results to be $2.2 \cdot 10^{-10}$ m/s^{-2} , i.e. our model predicts that a decrease of 1 m/s could be observed in about 140 years. This very small value has not been observed, but could be hidden within the error bars in recent determinations of c. Very precise laboratory measurements of c could detect this deceleration in a few decades.

In connection with this, it is remarkable that, using precision lunar orbital periods from 1978 to 1981, Van Flandern (1984) obtained a small deceleration in c:

$$-c'/c = (3.2 \pm 1.1)\, 10^{-11}/\text{year}. \tag{23}$$

This result represents a light deceleration of about $3 \cdot 10^{-10}\,\mathrm{m/s^2}$, in agreement, taking into account the error margins quoted, with our calculated value.

The variation of c should be tested with "mechanical" clocks such as those based on mechanical vibrators, pulsars rotation or planetary revolution, because atomic clocks periods depend on c.

Possibly this model could be also developed in terms of time dilatation instead of c decrease, but then the equations involved would be not so simple as the next section shows.

5. Jordan's dimensional numbers

Let us now recall an old numeric approach to cosmology. Inspired by Dirac, Jordan combined 6 important cosmological magnitudes in order to obtain adimensional numbers (Singh, 1974). The magnitudes were:

c is the speed of light;

f is the gravitational constant in GR: $f = 8\pi \mathrm{G}/\mathrm{c}^2$;

t_0 is the age of the oldest celestial object (close to the Universe age);

ρ_0 is the present matter density in the universe;

H_0 is the Hubble parameter;

R_0 is a length "constant" from Hubble galactic counts.

He showed that only 3 independent adimensional numbers can be constructed combining them:

$$t_0 H_0 \sim 1; \tag{24}$$

$$\frac{R_0}{ct_0} \sim 1; \tag{25}$$

$$f\rho_0 c^2 t_0^2 \sim 1 \tag{26}$$

and, from observations or estimations of the magnitude values, concluded that all this numbers where about one. This amazing result led him to the interpretation of R_0 as the curvature radius of a Riemannian closed space. From (25) and (26) Jordan also concluded that R_0 was expanding at the speed of light since the Big Bang. So we see that the basic equation (2) can be also obtained from completely different grounds.

Taking into account equations (5) and (26) and disregarding small numeric factors, he transformed (27) into the new expression:

$$fM \sim R_0. \tag{27}$$

From (28) an astonishing result was obvious: if R expands with cosmic time either f or M should increase. According to our model, the interpretation is that f is growing along with R, because c decreases. But Jordan never considered this possibility.

Taking into account the expression for f and rearranging (28) one can also obtain:

$$\frac{GM}{c^2} \sim R \tag{28}$$

an equation equivalent to (7) for Schwarzschild radius, except for the factor 2.

Within our model the exact adimensional numbers would be:

$$tH = 2/3; \tag{29}$$

$$\frac{R}{ct} = \frac{2}{3}; \tag{30}$$

$$\frac{GM}{Rc^2} = \frac{1}{2}. \tag{31}$$

These adimensional numbers describing our Universe are only derived from integral calculus and/or geometric factors. On the other hand, they should be valid not only nowadays but along the history of the Universe and therefore they describe the cosmological evolution of H, R, c and ρ.

Another immediate derivation of the present model is that the total mechanical energy of the Universe should be zero at any time, assuming by convention a vanishing potential energy at $R = \infty$

6. The flatness and the horizon problems

The overall flatness of the Universe, except for small local deformations of space-time near massive objects, is one of the key postulates of this model, as described in section 2.

Regarding the horizon problem, it vanishes as soon as the speed of propagation of light,

gravity and whatever other interactions are as fast as Universal expansion at any moment, so that the entire Universe emerging from the Big Bang singularity can be causally interconnected all the time (Fig. 2).

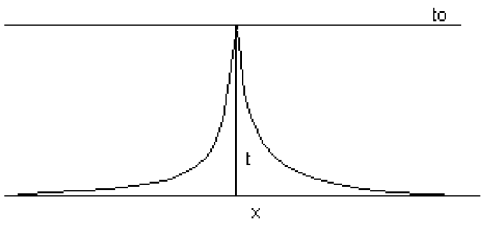

Figure 2: Scheme of light hyperboloid showing the observable Universe; x is a normalised spatial co-ordinate and t is the temporal co-ordinate from the origin ($t = 0$), when the entire Universe was accessible, up to now ($t = t_0$). This is not a light cone anymore because c decelerates.

Inflation theory, not yet included in the standard model, also solves those problems (Guth and Lightman, 1997). It proposes that a very small fraction of second after the Big Bang, an exponential acceleration of the expansion took place so that the Universe reached superluminical expansion rates. Very shortly after, the expansion decreased again to a "normal" Hubble flow. Superluminical expansion can be a problem within the theories of relativity because nothing should propagate faster than light. Inflationists argue that space-time frame itself could violate this principle but, in our physically observable world, space, time, matter and energy can not be disentangled. For instance, it has no meaning to consider time without matter or energy since, in such a case, time could not be measured, i.e. time is nothing but a measure of the rate of changes in matter or energy. In a similar way, we can only measure spatial lengths of objects, distances among objects or distances travelled by energy waves; and we can do it only by using objects or waves. For related reasons it is impossible observing far away without observing time ago.

Furthermore, if one assumes that the shape of space-time can propagate faster than c, then gravity, described in GR as a curvature of space-time, could reach any point faster than light does, perhaps even instantaneously. But, on the other hand, it is commonly accepted that gravity propagates through waves that can not be superluminical and, in fact, recent measurements of gravity speed agree with c_0 (Schewe et al., 2003). Therefore, if this measurements were confirmed, superluminical expansion of the Universe should be discarded.

Other shortcomings of inflation are the fine-tuning needed of the coupling constant in order to obtain the correct density profile in present Universe, the vacuum energy problem and the unnaturally flat potentials needed to solve the initial value problems (Moffat, 2002). Finally the low order quadrupole of the temperature anisotropy power spectrum from WMAP has lower amplitudes than expected from inflation (Efstathiou, 2003)

Within the present model the very fast expansion of the primitive Universe reveals to be not superluminical, although faster than present-day speed of light. Therefore the horizon problem is also solved without the need of an inflationary scenario. Neither cosmological constant nor dark energy, nor quintessence effects are required. In this way the cosmological constant/vacuum energy problem and the surprising coincidence of matter and dark energy dominance in present-day Universe (Caldwell et al., 1998) are also avoided.

From our perspective it is naturally understood why c is the maximum propagation speed for so many different phenomena such as waves, forces, particles, and any signal, interaction or causal connection between any two cosmic events. The reason appears to be surprisingly simple: since all of them happen within our Universe, they are limited to the maximum universal expansion rate: c.

7. The CBR temperature evolution

The present model agrees with the standard one in the way that temperature of the CBR has been decreasing as the scale factor increases, i.e.:

$$\frac{T}{T_0} = \frac{R_0}{R}, \tag{32}$$

where T_0 denotes today temperature. The interpretation is however slightly different: T, which is a statistic measure of the kinetic energy of photons, is inversely proportional to R and, therefore, directly proportional to c^2, according to Eq. (6). This relationship seems reasonable since the kinetic energy of any particle is proportional to its squared velocity. In other words : the momentum p of any particle is proportional to its velocity, so that the momentum of a photon should be proportional to c and its energy ($E = \rho c$) will be proportional to c^2.

It is commonly accepted that recombination of nuclei and electrons to form atoms was allowed when the Universe temperature dropped to $T_c \approx 3000$K (Weinberg, 1972), rendering the Universe transparent to electromagnetic waves. From that temperature we have that

$$\frac{T_c}{T_0} = \frac{3000}{2.73} = \frac{R_0}{R_c}. \tag{33}$$

So that this ratio is ca. 1100. On the other hand we have, taking into account Eq. (18):

$$\frac{t_0}{t_c} = \left(\frac{R_0}{R_c}\right)^{3/2} = 1100^{3/2}. \tag{34}$$

From this equation it is immediate that recombination time t_c was $3.8{\cdot}10^5$ years after the Big Bang, in full agreement with NASA results obtained from WMAP by

computational best fitting of parameters within standard model.

Combining equations (19) and (33) we obtain:

$$T = (z+1)^{3/2}\, T_0, \tag{35}$$

which gives the temperature of CBR in the past as function of z and T_0. This last equation differs from standard model (Ellis, 2000). Both relationships can be tested by looking for excited molecules at high redshift. In fact this has been already done for a gas cloud at $z = 2.34$ (Srianand et al., 2000), finding a temperature range from 6.0 to 14K in agreement with standard model (predicting $T = 9.1$K) but also with ours ($T = 6.1$K). Again, further observations are needed to rule out at least one of them.

In standard model the energy density of the Universe is proportional to T^4 and inversely proportional to R^4 since the energy of each photon is considered to be proportional to T ($\propto 1/R$). In the present model this is also true, but when passed to mass equivalent density units, in order to compare with matter density, by dividing by c^2 ($\propto 1/R$), it results to be inversely proportional to R^3 and follows the same law that matter density. This statement implies that, as long as the ratio of photons to nucleons has been constant, the matter density has been about 9000 times higher than the energy density and our Universe has been matter-dominated along his history. This ratio justifies *a posteriori* the absence of a radiation pressure term in the above derived equations that govern universal dynamics.

Further implications of the present model on the abundance of light elements, the CBR fluctuation spectrum or the properties of quasars will be addressed in future publications.

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ON EINSTEINIAN ORBITS OF CELESTIAL BODIES

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It can be demonstrated that no motion of masses can generate gravitational waves. Accordingly: *i*) the time decrease of the orbital period of the famous binary PSR1913+16 cannot yield an experimental proof of the emission of gravitational waves; *ii*) measurements of the propagation of the quasar J0842+1835 radio-signals past Jupiter cannot reveal the propagation of gravitational waves sent forth by the planet in its motion around the Sun: indeed, this motion does not generate any gravitational radiation; *iii*) the binary RX J0806.3+1527 has the shortest known revolution period (only 321 s): however, it cannot be a candidate for the detection of gravitational waves because no kind of motion of a mass can give origin to a gravitational wave.

Introduction

Innumerable papers have been written on the Einsteinian orbits of the celestial bodies. For clear reasons, the overwhelming majority of them are of a perturbative character. In the present Note I consider the above orbits only so far as the hypothesized emission of gravitational waves is concerned. Now, we shall see that from this standpoint it is possible to develop some very simple and general considerations from which one can conclude that *no motion of the celestial bodies gives origin to a gravitational radiation.*

1. Theory

Several arguments prove that no motion of masses can generate gravitational waves [1]. An essential demonstration may be resumed in the following way.

Consider a *continuous medium* characterized by whatever mass tensor $T_{jk}(x)$, $(j,k=0,1,2,3)$, and let $g_{jk}(x)$ be the solution of the Einstein field equations corresponding to a generic motion with respect to a given reference system $x \equiv (x^0, x^1, x^2, x^3)$. Suppose to follow ideally the motion of a given *mass element* describing a world line L, and suppose that at a given time this element begins to emit a gravitational wave. Now, if we refer its motion to some Riemann-Fermi coordinates $z \equiv (z^0, z^1, z^2, z^3)$ [2], the components $h_{jk}(z)$ of the metric tensor will be equal to some *constants* for *all* points of L. This means that the gravitational field *on* L can be obliterated: consequently, no gravitational wave can be actually sent forth by the considered mass element. But line L is quite generic, and therefore no motion of the medium gives origin to a gravitational radiation.

It is implicit in the above reasoning that no gravitational damping force has influenced the motion of our mass element.

2. On the binary PSR1913+16

According to many authors, an indirect experimental proof of the physical existence of the gravitational waves is given by the time decrease of the orbital period P_b of the binary radiopulsar PSR1913+16 [3]. The measured value of $\mathrm{d}P_b/\mathrm{d}t$ is $-(2.30 \pm 0.22) \cdot 10^{-12}$, while the quadrupole formula of the linearized relativity gives a $\mathrm{d}P_t/\mathrm{d}t$ due to a hypothesized emission of gravitational radiation equal to $-2.4 \cdot 10^{-12}$. An excellent agreement with the observational data has been also obtained by computations at third order of the gravitational constant and fifth order in v/c. However, this agreement is rather suspect owing to the unreliability of the adopted perturbative treatments (cf.[4]).

As a matter of fact, we know from the theoretical proof of sect.**1** that no motion of the stars of the above binary system can generate gravitational waves. Accordingly, it would be necessary to re-examine carefully the influence on $\mathrm{d}P_b/\mathrm{d}t$ of those realistic effects that Damour and Taylor have discarded as scarcely significant [5].

On the other hand, the computations of Taylor *et alii* are based on the assumption that the two stars of the system PSR1913+16 can be treated as *point* masses so far as their motions are concerned: now, point masses interacting only gravitationally describe *geodesic* lines (cf. the first paper cited in [1]), i.e. their motions are "free", "inertial" motions *with* ***no*** *radiation damping.*

The conclusion is obvious: the binary PSR1913+16

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gives no experimental proof of the real existence of the gravity waves.

3. On the motion of Jupiter

As is well known, as a consequence of the quadrupole formula of the linearized relativity, the power of the gravitational radiation sent out by Jupiter in its motion around the Sun is $\approx$ 450 watt. (The power of the solar *electromagnetic* radiation is about 10^{24} times greater). From the standpoint of the *exact* theory, this result is a pure nonsense because – cf. sect.**1** – no motion of a body generates gravitational waves. However, the present astrophysical community gives an excessive credit to the linearized version of general relativity and to perturbative computations starting from it. Thus, in recent times we have seen a bombastic proclamation according to which an indirect experimental detection of the gravitational waves emitted by Jupiter in its motion would be quite possible, see Kopeikin and Fomalont [6]. These authors declare that, owing to a rare alignment of Jupiter's motion against the quasar J0842+1835, measurements of the propagation of the quasar radio-signals past Jupiter must be sensitive to the propagation of the gravitational radiation emitted by the planet. However, Asada [7] and subsequently Will [8], by means of more reasonable perturbative treatments, have proved the non-existence of the Kopeikin-Fomalont effect.

Of course, this result is obvious from the rigorous point of view of the exact formulation of general relativity.

4. On the binary RX J0806.3+1527

This binary system is composed of two white dwarfs revolving around each other at a distance of only $8 \cdot 10^4$ km. The speed of the orbital motion is over 10^3km/s, the orbital period amounts to 321 s: it is the shortest known revolution period, see Israel *et alii* [9]. These authors believe that the above binary is an excellent candidate for the detection of the gravitational waves, owing to the shortness of its period. According to them, the space experiment LISA (Laser Interferometer Space Antenna), that will be launched within 2020, will be able to reveal the gravitational waves emitted by RX J0806.3+1527. Of course, this is a pure wishful thinking, see sect.**1**.

In conclusion, I desire also to emphasize that the astrophysical community "ignores" that the so-called gravitational waves are mere mathematical undulations devoid of a real energy and a real momentum [10]. But, alas, the chase to these phantoms has become a gigantic business that dissipates astronomical amounts of public money.

"Sir, I have found you an argument:
I am not obliged to find you
an understanding."

Samuel Johnson

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GEOPHYSICAL AND PLANETOLOGICAL DATA ON BIRTH OF SUBSTANCES IN THE SOLAR SYSTEM

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The row of observations inside the Solar system has been analysed. It has been shown that continuous birth of matter and radiation from some pramatter-energy exists.

Between non-stationary and stationary cosmology if we compare their actual arguments already for a long time a sort of balance of viewpoints there has been [1–3]. The situation does not change yet, which is connected with certain stagnation of the theory: there is no confidence of successful end, complete association in leading — superstring — theory of substance and gravitation, where great difficulties are marked [4–5]. Therefore there is a search of new directions [6]. All this is fair, for in essence there are no new experimental facts. Such experiments removing the limits nowadays known, are only being prepared or are beginning [7, 8]. Therefore in the given work we pay attention to the fact that already now there exist observation data of the Solar system, which are almost unknown, or which are not enough discussed, but give the most valuable information [9–11]. Its analysis confirms the main thesis of stationary cosmology regarding slow continuous birth of substance and energy from some pramatter in Metagalaxy [9–12].

1. Electromagnetism of the Solar system

A. In works [10–12] some problems of researches of electromagnetism and dynamics of planets were considered by us unifield (UF), Blackett's concept of space magnetism proved to have an advantage over the magnetohydrodynamic one (MHD). Now we can observe more clearly a great importance of the UF-approach towards gravitation and electromagnetism, to macro and microworld [6]. This importance follows from the analogy of the magnetic moments of electron and cosmic bodies:

$$\mu_0 = \frac{eh}{4\pi mc}; \tag{1a}$$

$$\mu \cong \frac{\sqrt{\gamma}P}{c}; \tag{1b}$$

$$\left[\frac{e}{m}\right] = [\sqrt{\gamma}]\,; \tag{1c}$$

$$[P] = [h]\,, \tag{1d}$$

where e, m are charge and mass of an electron, γ is gravitational constant, h is quantum Planck constant, P is moment of axial rotation of a massive cosmic body.

It is necessary to note, that in calculations of the

$$\mu = \frac{\sqrt{\alpha^n\gamma}P}{4\pi c} \tag{2}$$

magnetic moments of Io and the Moon having practically the equal mass deviations on two orders are observed [9,10]. But if we take into account quantum electrodynamic constant α, instead of the formula (1b) we will receive the expression (1).

Quantized levels n, as it can be seen, phenomenologically take into account physical-chemical properties and astronomical characteristics of movement. On the contrary, knowing the latters, we can predict level n. That is, the complete theory of magnetism includes also some elements of the MHD-concept (Vasiljev) [9, 10].

B. Researches of internal thermal flows of planets, the Sun, stars, quasars have shown significant deviation from the standard notions about equality of power of internal sources with observable radiation. For example, in the 1960^{th} it was determined, that the internal powers of thermal flows of the Earth are more than the power of its radioactive sources, the planets - giants radiate appreciably more energy, than they receive from the Sun. Thus, the large cosmic objects have the property to radiate their own, "mass," unifield electromagnetic radiation. It has appeared, that such an effect is inherent also in the Sun: neutrino thermonuclear flows

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Table 1: Calculation of magnetic moments of the Sun and planets using modified unifield formula (1)

Object	$\mu, Gs \cdot cm^3$	Calculated	Mechanical Moment of axial rotation	α^n	level n
Sun	$1.5 \cdot 10^{32}$	$1.5 \cdot 10^{32}$	$1.8 \cdot 10^{48}$	α	1
Mercury	$2.4 \cdot 10^{22}$	$5.7 \cdot 10^{22}$	$6.7 \cdot 10^{36}$	α^{-1}	-1
Venus	$0.4 \cdot 10^{22}$	$1.0 \cdot 10^{22}$	$2.0 \cdot 10^{38}$	α	1
Earth	$8.1 \cdot 10^{25}$	$4.5 \cdot 10^{25}$	$6.2 \cdot 10^{40}$	α^0	0
Mars	$2.5 \cdot 10^{22}$	$1.0 \cdot 10^{22}$	$2.0 \cdot 10^{39}$	α^2	2
Jupiter	$2.0 \cdot 10^{30}$	$2.8 \cdot 10^{30}$	$4.1 \cdot 10^{45}$	α^0	0
Saturn	$0.5 \cdot 10^{29}$	$0.4 \cdot 10^{29}$	$7.4 \cdot 10^{44}$	α	1
Uranus	$0.4 \cdot 10^{28}$	$0.8 \cdot 10^{28}$	$1.4 \cdot 10^{43}$	α^0	0
Neptun	$1.0 \cdot 10^{28}$	$1.5 \cdot 10^{28}$	$2.0 \cdot 10^{43}$	α^0	0
Moon	$2.0 \cdot 10^{19}$	$1.2 \cdot 10^{19}$	$2.5 \cdot 10^{36}$	α^2	2

have appeared to be appreciably less than those following from the thermodynamic theory of solar energetics. The fantastic huge radiations of quasars became a separate problem of cosmology. The weak scientific exchange between various fields of knowledge has resulted in appearance of dozens of different hypotheses concerning these effects, identical in their nature.

Let's consider therefore the basic observable material (tab. 2) and analyse it from the point of view of the UF-approach.

For this purpose it is necessary to find the second Blackett's relation for the uniform description of electromagnetic radiation similar to relation (1b) for magnetism.

It appears to have the following form:

$$Q_e \cong \frac{\alpha^s \gamma m^2 c}{R^2}, \tag{3}$$

where m is mass of object in gravitational "lattice" — between stars of Galaxy, s is level of radiation, $R_{ef} = 1.7 \cdot 10^{18}$ cm is effective distance in "lattice."

The most precise measurements of Q_e for the Earth and the Sun allow to find R_{ef}, if level s for the Earth 1, and for the Sun - 0. Thus the natural putting in order occurs: non-thermonuclear objects have a level of radiation 1, the stars such as the Sun - 0, supergiants $s = -1$ etc. As it can be seen, all objects show uniform law: pramatter, a unifield part Q_e is present in their radiation.

Let's emphasize the coordination of the description of all object radiation with the data of the Sun's neutrino telescopy: only 1/3 of the Sun's radiation is thermonuclear in its origin. Therefore it should be necessary to emphasize this main result, which is to be confirmed by exact experiments [7]. If we find out, that oscillations of neutrino completely account for the lack of neutrino, it will be necessary to change the astrophysical model of the Sun, for it does not contradict the observable data for all the stars ($Q \geq Q_e$).

2. Generalized statistical-wavenmechanical equation and cosmogony of the Solar system

The certain development of Blackett's method is the generalized statistical-wavemechanical Fenjesch-Kuzjmenko-Skorobogatov equation:

$$\Delta\psi - \frac{1}{2b^2}\frac{\partial U}{\partial \omega}\psi + \frac{i}{b}\frac{\partial \psi}{\partial t} = 0. \tag{4}$$

describing micro- and macrocosm in a unified manner.

In that specific case with Markov constant $b = h/4\pi m$ in linear approximation for density of potential energy $U = \omega V$ we receive Schrdinger non-ctationary equation. Followinng from it, the stationary equation, of free hydrodynamical transfer explains the problem "of Bode-Titius quantum" law, as the result of standing quasi de Broglie waves [11–13]. The calculation of mass distribution in the Solar system [11] has especially clearly shown a greater importance (3) as compared with classical mechanics. This problem was not solved in cosmogony and the astronomers were engaged in searches of a rather massive planet behind Pluto for half a century as disturbance in movements of Neptun had been fixed. Kuiper small bodies belt

$$\left(\frac{e}{m_e}\right)^2 \cong \gamma_e \cong 2,5.10^{35};$$

$$\left(\frac{e}{m_p}\right)^2 \cong \gamma_p \cong 10^{29};$$

$$\left(\frac{Q}{M}\right)^2 = \gamma = 6,7.10^{-8} \tag{5}$$

has been discovered quite recently in accordance with wavemechanical calculation, which says that there can be such bodies between Neptun and Pluto and farther

Table 2: Internal radiation of typical cosmic objects and calculation of "mass" unifield contributions to their general electromagnetic radiation [11, 12]

N	Object	Complete radiation, Q, erg/s	Unifield Contribution, Q_e erg/s	α^n	level s	$Q \geq Q_e$	mass, g
1	Earth	$3 \cdot 10^{20}$	$1.8 \cdot 10^{20}$	α	1	+	$6 \cdot 10^{27}$
2	Jupiter	$4 \cdot 10^{24}$	$4 \cdot 10^{24}$	α	1	+	$2 \cdot 10^{30}$
3	40-Eridani	$1.6 \cdot 10^{31}$	$0.4 \cdot 10^{31}$	α	1	+	$0.9 \cdot 10^{33}$
4	Sun	$4.0 \cdot 10^{33}$	$2.8 \cdot 10^{33}$	α^0	0	+	$2 \cdot 10^{33}$
5	Capella	$8.8 \cdot 10^{35}$	$2.7 \cdot 10^{35}$	$\alpha^{-1/2}$	$-1/2$	+	$6.6 \cdot 10^{33}$
6	Rigel	$8.0 \cdot 10^{38}$	$6.4 \cdot 10^{38}$	α^{-1}	-1	+	$8.0 \cdot 10^{34}$

Table 3: The data of interplanetary space stations on meteoric precipitation on planets, ton/terrestrial day (Ksanfamaliti) [16]

Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptun
16	250	300	35	$5 \cdot 10^4$	10^4	$2 \cdot 10^3$	$3 \cdot 10^3$

behind Pluto - the same or smaller ones - comets, etc. [11].

With no less confidence, calculations of meteoric precipitation on to the planets of the Solar system were made out from unifiedfield correlations for an electron, a proton and a cosmic body (4)

Their laws were not known at all and look more like notions [14 - 16].

3. On the problem of continuous growth of cosmic body masses and nature of gravitation

The above mentioned deep connection of substance and all interactions with gravitation has been formulated by Heisenberg and it can precisely be illustrated for substance even in the elementary approach: the masses of all elementary particles are calculated as consequent disturbance of uniform pramatter-energy, similar to an electromagnetic field [16].

It reminds Einstein unifield etheric dynamic program which however, originates from curvatures of geometry. Since there is much to be done to fulfill the maximum program - association with gravitation - it is useful to pay attention to models of such association [16]. According to them the gravitational phenomena are the result of absorption and growth of bodies from pramatter-energy. Absorbed from vacuum pramatter turns into substance and radiation. The consequences of such models on the observable geophysical phenomena are positively discussed (Atcjukovsky, Veselov, Burago) [16]. Model outgoing from [4] and Mach principle emphasizing, that gravitation is the cosmological effect, gives the following formulas for electromagnetic radiation of quasar and growth of cosmic body mass per second:

$$Q_e \approx 10^{-54} \gamma M \mu c;$$

$$m^* = \frac{\gamma M m}{R^2 c}, \qquad (6)$$

where $R = 10^{28}$ cm , the mass of quasar $\mu \approx 10^{41} - 10^{42}$ g, $M \approx 10^{56}$ g.

Naturally, the appreciable growth of the Earth is going on for billions of years and it is desirable to make geological interpretations more obvious. It is possible, to do so by means of applying both physics of elementary particles and solar plasma.

The characteristics of the latter at the orbit of the Earth: $R = 1.5 \cdot 10^{13}$ cm, velocity $v = 5 \cdot 10^7$ cm/s, density of particles $n \approx 10$ cm^{-3}. The complete flow per one second $N = 4\pi R^2 n v$.

The surprising feature is known: mainly protons are observed in the flows of the particles as if there were little helium on the Sun or it were not present where at all! Therefore, believing, that the plasma is mainly shock overshoots of born protons, let's calculate additional Q_{add} to thermonuclear energy generated by the Sun - unifield energy Q_e ,

$$Q_{add} \approx N\varepsilon, \qquad (7)$$

where ε is energy, released at birth of a proton from pramatter. According to quark theory $\varepsilon \approx m_p c^2$, where $m_p \approx 1.7 \cdot 10^{-24}$ g is mass of protons. From (6) we really receive $Q_{add} \approx Q_e \approx 2.8 \cdot 10^{33}$ erg/s (see tabl. 2).

Now there is not any doubt as to the origin of a flow of hydrogen from a nucleus of a Galaxy [2]: the processes of birth are much more intensive in it than in stars.

Nowadays a number of astronomers and astrophysics consider, that the processes of birth of substance in nucli of galaxies are really observed (Kardaschov et al.) [2, 16].

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THE SUPERMASSIVE CENTRE OF OUR GALAXY *ET CETERA*

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We show that the supermassive celestial body at the centre of the Milky Way and the two supermassive celestial bodies at the centre of the distant galaxy NGC 6240 cannot be black holes.

Introduction

Sophisticated observations made by a team of astrophysicists of the M.P.I. for Extraterrestrial Physics have allowed to determine the positions of the star denoted with the symbol S2 in its motion around the Milky-Way's centre [1]. It has come out that the S2 orbit is a Keplerian ellipse with a period of 15.2 years.

We acknowledge the accuracy of the above research, but we are rather sceptical about the conclusion of the authors according to which the centre around which S2 revolves is a black hole. As far as an "explanation" is an explanation, it is necessary that what is explained is a *logical* consequence of the premiss and of what is used for explaining. As a matter of fact, the existence of the observed Keplerian orbit can only explain the presence of a punctual supermassive body at the centre of the Milky Way – and not of a supermassive black hole. This conclusion will be corroborated in a detailed way in the following sections.

1. Theoretical considerations

If r, θ, ϕ are spherical polar coordinates, the solution of the problem of the Einsteinian gravitational field generated by a point mass M at rest is given by the following spacetime interval [2]:

$$\mathrm{d}s^2 = [1 - \frac{2m}{f(r)}]c^2\mathrm{d}t^2 - [1 - \frac{2m}{f(r)}]^{-1}[\mathrm{d}f(r)]^2 - \\ -f^2(r)[\mathrm{d}\theta^2 + \sin^2\theta\mathrm{d}\phi^2], \quad (1)$$

where: $m \equiv MG/c^2$; G is the gravitational constant and c the speed of light *in vacuo*; $f(r)$ is *any* regular function of r.

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If one chooses $f(r) \equiv r$, one obtains the so-called standard form of solution, *erroneously* named "by Schwarzschild", but in reality due to Hilbert, Droste and Weyl [2].

One has the *original* form of solution given by Schwarzschild in 1916 if one chooses $f(r) \equiv [r^3 + (2m)^3]^{1/3}$; Schwarzschild's $\mathrm{d}s^2$ holds in the *entire* spacetime, with the only exception of the origin $r = 0$: it is "maximally extended". Remark that Schwarzschild's form of solution is diffeomorphic to the part $r > 2m$ of the standard form. For $r < 2m$ this part loses any mathematical and physical meaning - as it was repeateadly emphasized by Einstein and by all the Great Men who developed the general relativity – because the solution becomes non-static, the radial coordinate r becomes a time coordinates, and the $\mathrm{d}s^2$ loses its physical "appropriateness". Now, the invention of the senseless notion of black hole was originated by an odd reflection on the region $r < 2m$. If the treatises had expounded the original form of Schwarzschild in lieu of the standard form, the notion of black hole would not have come forth.

In conclusion, the physical results are those and *only* those that are *independent of the particular choice* of the function $f(r)$. But the fictive notion of black hole owes its origin to a misinterpretation of the part $r < 2m$ of a *particular* form: the *standard* form.

2. Experimental results and conclusions

Some months ago Schödel and other 22 authors published a paper [1] in which they report "ten years of high-resolution astrometric imaging" that have allowed "to trace two-thirds of the orbit of the star, [denoted with S2], currently closest to the compact radio-source

Sagittarius A* [SgrA*]." They write: "The observations, which include both pericentre and apocentre passages, show that the star is on a bound, highly elliptical keplerian orbit around SgrA*, with an orbital period of 15.2 years and a pericentre distance of only 17 light hours. The orbit with the best fit to the observations requires a central point mass of $(3.7 \pm 1.5) \times 10^6$ solar masses ($M_\odot$). The data no longer allow for a central mass composed of a dense cluster of dark stellar objects or a ball of massive, degenerate fermions."

Schödel *et alii* [1] interpret their results as an experimental proof of the existence of a supermassive black hole at the centre of our galaxy. Evidently, they are victims of the very diffuse, but erroneous opinion (see sect.**1**) that the gravitational collapse of a massive celestial body must generate a black hole. On the other hand, the experimentally observed orbit is *Keplerian*, that is described by the (nonrelativistic) Newtonian theory. From the standpoint of *logic and experience*, one can *only* affirm that at the centre of Milky Way there is a punctual object with a huge mass. (It is interesting to remark that the fictitious event horizon for a point mass $\approx 4 \times 10^6 M_\odot$ would be situated at a distance of ≈ 26 light seconds!).

APPENDIX

In a *NASA Press Release*, dated November 20th, 2002, entitled "A Super Galactic Discovery", we read: "For the first time, scientists have found proof of two supermassive black holes together in the same galaxy. These black holes are orbiting each other and will merge several hundred million years from now. The event will unleash intense radiation and gravitational waves [....] and leave behind an even larger black hole than before.

NASA's Chandra X-ray Observatory spotted the two black holes in the galaxy NGC 6240. The observatory was able to "see" them because the black holes are surrounded by hot swirling vortices af matter called accretion disks. Such disks are strong sources of X-rays."

This is pure science fiction! Demostration. *In primis*, as we have seen in sect.**1**, the very notion of black hole is a nonsense. *In secundis*, even if we believed in the existence of the black holes, there would be "no way of asserting through some analogy with Newtonian gravitational theory that a black hole could be a component of a close binary system or that two black holes could collide. An existence theorem could first be needed to show that Einstein's field equations contained solutions which described such configurations." [3]. *In tertiis*, the eventual formation of an accretion disk, strong source of X-rays, is *not* linked to a particular choice of the arbitrary function $f(r)$ (see sect.**1**)– in particular to the standard choice $f(r) \equiv r$.

In conclusion, no black hole has been detected by Chandra X-ray observatory. And never gravitational waves will travel over the world, because they are pure mathematical undulations, completely devoid of any *physical* reality [2], [4], [5].

"La vérité, l'âpre vérité."
Danton

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COSMOLOGICAL MODELS WITH $G\rho/\Lambda$ AS A CONSTANT

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Following the gravitational theory proposed by Berman& Rahman [4], in this paper we have constructed a homogeneous and isotropic cosmological models which satisfy the present day observational data and the initial conditions as proposed by Sivaram et al [7] with additional requirement $G\rho/\Lambda$ as a constant.

1. INTRODUCTION

At the time of Einstein, the cosmological constant Λ has no direct physical meaning, but today it is interpreted as the "Ground state energy" of the vacuum, also it has been shown That Λ is not a constant, but it is variable *quantity*[1,2,3,4]. In the Einstein field equations the gravitational constant G has been introduced via the Newtonian approximation of the Einstein field equation, Latter on the constant G is related to the long-range scalar field and hence, it varies as the universe expands [5] to incorporate the variable cosmological constant $\Lambda$and variable gravitational constant G into the Einstein field equations, a method has been proposed by Berman & Rahman [4] on the basis of the conservation law. The field equations are expressed similar to the Einstein field equations

$$R_{ij} - \frac{1}{2}Rg_{ij} = -\frac{8\pi G}{c^4}T_{ij} - \Lambda g_{ij}. \qquad (a)$$

But G and Λ are variable here. The conservation law is the same as in the Einstein theory i.e.

$$T_{ij;i} = 0. \qquad (b)$$

Which on applying to (2) gives

$$\frac{8\pi G}{c^4}T^i_j - \Lambda_i g^i_j. \qquad (c)$$

The equation (c) restricts the variation of G and Λ in Homogeneous and isotropic Cosmological models of the universe. Berman & Rahman [4] have constructed cosmological model with

$$G\rho = At^{-2};$$

$$\Lambda = Bt^{-2}. \qquad (d)$$

In the present paper we shall study the cosmological models by assuming the ratio $G\rho/\Lambda$ as a constant i.e.

We propose that

$$G\rho/\Lambda = -\alpha c^2/8\pi, \qquad (1)$$

where α is a constant and therefore the variations of $G\rho$ and Λ given in (d) is included in (1).

2. EQUATION GOVERNING THE COSMOLOGICAL MODELS

The fundamental equations governing a homogeneous and isotropic cosmological models are as follows

The acceleration equation is

$$\frac{3\ddot{R}}{R} = -4\pi G\left[\frac{3P}{c^2} + \rho - \frac{\Lambda c^2}{4\pi G}\right]. \qquad (2)$$

The velocity equation is

$$\frac{3\dot{R}^2}{R^2} + \frac{3kc^2}{R^2} = 8\pi G\rho + \Lambda c^2. \qquad (3)$$

The pressure, density relation is

$$P = \beta\rho c^2, \qquad (4)$$

where β is a positive constant for $\beta = 0$, $p = 0$ & then the model is pressure less and for $\beta = \frac{1}{3}$, $3P = \rho c^2$ & then the model is filled with radiation.

The variation of density ρ is derived from the conservation equation as

$$\dot{\rho} = -3\,(1+\beta)\,\rho\frac{\dot{R}}{R}. \qquad (5)$$

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The variation of G and Λ are governed by the equation

$$8\pi\dot{G}\rho + \dot{\Lambda}c^2 = 0. \tag{6}$$

Also for a realistic cosmological model of the universe, we must have

$$\Lambda < 0 \& \dot{\Lambda} > 0 \ \& \ G > 0, \ \dot{G} > 0 \tag{7}$$

during the expansion of the universe. As a consequence of the result the equation implies that

$$\dot{R} < 0 \tag{8}$$

during the expansion of the cosmological model and hence, the cosmological model is either ever expanding or oscillatory

3. VARIATION OF ρ, G & Λ

The variation of ρ is already given in the equation (5). For the determination of the variation of G & ρ from equation (6) we assume the dependence of $G\rho$ and Λ as

$$\frac{G\rho}{\Lambda} = -\frac{\alpha c^2}{8\pi}, \tag{9}$$

where α is a positive constant according to the conditions given in (7). Before going to discuss the variations of G and Λ it would be worthwhile to point out here that $\alpha \neq 1$. It may be verified as follows.

For $\alpha = 1$, the equation (9) gives

$$8\pi G\rho + \Lambda c^2 = 0. \tag{10}$$

Differentiating this equation with respect to time we get

$$8\pi G\dot{\rho} + 8\pi\dot{G}\rho + \dot{\Lambda}c^2 = 0. \tag{11a}$$

The above equation is simplified with the help of the equation (6) as

$$8\pi\dot{G}\rho = 0 \text{ which implies } \dot{\rho} = 0 \text{ or } \rho = \text{const}. \tag{11b}$$

Which may not be true because the universe is expanding, therefore the density of the universe is decreasing as the universe expands and hence α may not be equal to 1.

After simplification and integration under the conditions

$$R = R_1, \ G = G_1, \ \rho = \rho_1 \ \& \ \Lambda = \Lambda_1 \tag{12}$$

we get the following equations:

$$\rho = \rho_1 \left[\frac{R}{R_1}\right]^{-3(1+\beta)}; \tag{13}$$

$$G = G_1 \left[\frac{R}{R_1}\right]^{\frac{3(1+\beta)}{1-\alpha}} \tag{14}$$

and

$$\Lambda = \Lambda_1 \left[\frac{R}{R_1}\right]^{\frac{3\alpha(1+\beta)}{1-\alpha}}. \tag{15}$$

The constant R_1, G_1, ρ_1 & Λ_1 are to be decided via the observational and estimated data later on.

During the expansion of the universe ρ and G are positive and decreasing whereas Λ is negative and increasing and then from the above equations we get

$$1 + \beta > 0 \ \& \ 1 - \alpha < 0. \tag{16}$$

The first inequality given in the equation (16), is obvious, because $0 \leq \beta \leq 1/3$.

4. VARIATION OF R

Substituting the value of $8\pi G\rho$ from the equation (9) in the equation (3) we get

$$\dot{R} = c\sqrt{\left[\left(\frac{1-\alpha}{3}\right)\Lambda R^2 - k\right]}. \tag{17a}$$

Putting the value of Λ in the above equation we get

$$\dot{R} = c\sqrt{AR^m - k}, \tag{17b}$$

where

$$A - \left(\frac{1-\alpha}{3}\right)\Lambda_1 R_1^{\frac{-3\alpha(1+\beta)}{1-\alpha}}$$

$$\& \ m = \frac{2 + \alpha(1+3\beta)}{1-\alpha}. \tag{18}$$

According to the discussed conditions the constant A is positive and constant m is negative the exact solution of the equation (17) under the condition $R = 0$, $T = 0$ are as follows

$k = 0$:

$$R^{\frac{2-m}{2}} = \frac{(2-m)\sqrt{A}}{2}ct; \tag{19a}$$

$k = -1, \quad m = -1$:

$$\sqrt{R^2 + AR} - \frac{A}{2}\log \times$$

$$\times \left[\frac{(2R + A \quad) + 2\sqrt{R^2 + AR}}{A}\right] = ct; \tag{19b}$$

$k = -1, \quad m = -2$:

$$\sqrt{A + R^2} - \sqrt{A} = ct. \tag{19c}$$

The cosmological models for which the expansions are given by (19a, 19b, 19c) are ever expanding models, for $k = 1$ and $m = -1$, the equation $(17b)$, gives

$$\frac{\sqrt{R}}{\sqrt{A-R}}dR = cdt. \qquad (19d)$$

Therefore, $R < A$ and hence the model is oscillatory the integration of the equation (4.) is possible under the condition $R = 0$ & $t = 0$ when $R < A/2$ and we get

$$\frac{A}{2}cos^{-1}\left(\frac{A-2R}{A}\right) - \sqrt{AR-R^2} = ct;$$

$$0 < R < A/2.$$

where as for $R > A/2$, the constant of integration of their solution (4.) may not be evaluated under the condition $R = 0$, $T = 0$.

5. VALIDITY OF THE MODELS

According to the f-gravity theory [7] a model of the universe should satisfy the following initial conditions

$$R = R_1 = 10^{13} \text{ cm};$$

$$\rho = \rho_i = 10^{17} \text{ c.g.s. unit};$$

$$\Lambda = \Lambda_i = -10^{28} \text{ cm}^{-2};$$

$$t = t_i = 10^{-23} \text{ sec} \qquad (20)$$

then from the equation (9), we get

$$\alpha = -\frac{8\pi G_i \rho_i}{\Lambda_i c^2}.$$

Substituting the numerical values from

$$\alpha = 1.84 \qquad (21)$$

now putting $\alpha = 1.84$ and $\beta = 1/3$ we have, $m = -6.7$.

Therefore, except the model represented in (19), other models may not be suitable to represent as a realistic model of the universe in the radiation-dominated era. After putting the values we get

$$A = 9 \cdot 10^{30} \text{ c.g.s.unit},$$

$$R^{4.35} = 13 \cdot 10^{15} ct \ \& t_i = 10^{-52} \text{ sec}, \qquad (22)$$

which is very small as compared to the estimated value of t_i. Therefore, the model under consideration may not be treated as a realistic model of the universe representing in the radiation dominated era.

According to the present day observations which are of cosmological significance we have [2, 3, 4].

$$G = G_0 = 6.6 \cdot 10^{-8} \text{ c.g.s. unit};$$

$$\rho = \rho_0 = 3 \cdot 10^{-31} \text{ g} \cdot \text{cm}^{-3};$$

$$t = t_0 = 6.3 \cdot 10^{17} \text{ sec};$$

$$R = R_0 = 10^{28} \text{ cm};$$

$$\Lambda = \Lambda_0 = -10^{-57} \text{ cm}^{-2}. \qquad (23)$$

The density ρ_0 given in (23) in the observed density at the present epoch. Whereas, there is a possibility of the "Missing Mass" in the universe [3] and then the present density ρ_0 would greater than $3 \cdot 10^{-31} g \cdot cm^{-3}$ at present epoch the universe is the matter dominated and hence $\rho = 0$. The equation (3) then gives $\beta = 0$. After putting numerical values we get $\alpha = -0.553 < 1$.

To make $\alpha > 1$, the only suitable assumption is to propose the missing mass in the universe, and therefore, ρ_0 is larger than $3 \cdot 10^{-31} g \cdot cm^{-3}$. The amount of the missing mass in the universe may be determined as follows. For $\beta = 0$, the constants A and m given in (18) reduces to

$$A = \frac{(1-\alpha)\,\Lambda_0}{3} R_0^{\frac{-3\alpha}{1-\alpha}} \ \& \ m = \frac{2+\alpha}{1-\alpha}$$

after simplification we get

$$\alpha = 2 \text{ (approx...)} \ \& \ \rho_0 = 10^{-30} \text{ g} \cdot \text{cm} \qquad (24)$$

5.1. The radiation dominated era

In the radiation dominated era the values of α and m are given in the equation $\alpha = 1.84$ and $m = -6.7$ for $k = -1$ the equation (17b) gives after simplification under $R = R_2$, $t = t_2$ as

$$R - R_2 + \frac{A}{2}\left[\frac{R^{m+1}R_2^{m+1}}{(m+1)}\right] -$$

$$-\frac{A^2}{8}\frac{\left(R^{2m+1} - R_2^{2m+1}\right)}{(2m+1)} + \ldots = c\,(t - t_2)\,. \qquad (25)$$

The constant R_2 & t_2 may be determined from other suitable consideration, provided the time t_2 exists in the radiation dominated era, if the time t_2 does not exist in the radiation dominated era, the equation (25) is meaning less in the radiation dominated era.

In a similar way we may have approximate solution for close model $(k = 1)$ as follows:

If $0 < R^{-m} < A$

$$\frac{2R^{\frac{-m+2}{2}}}{A^{1/2}\,(-m+2)} + \frac{R^{\left(\frac{-3m+2}{2}\right)}}{A^{3/2}\,(-3m+2)} +$$

$$+\frac{3R^{\left(\frac{-5m+2}{2}\right)}}{4A^{5/2}\,(-5m+2)} = ct. \qquad (26)$$

Here the expansion for $R^{-m} > A$ may not be possible as the model is oscillatory and its maximum expansion is

$$R_{max} = (A)^{-1/m}$$

5.2. The matter dominated era

For the approximate determination of R in the matter dominated era one has to first determine the value of α. As we have seen that α may not be determined in the matter dominated era, in the same as we have determined in the radiation dominated era. It is because of the necessity of the assumption of the missing mass in the universe, which has not yet been known. Because of not knowing α, the constants m and A the possible approximate calculation is of theoretical significance only and hence we leave it here.

6. COSMOLOGICAL MODELS WHEN MATTER AND RADIATION ARE COMPARABLE

In the above sections we have discussed the cosmological models in the radiation-dominating era and in the matter-dominating era, but in between those two, there must be an era when the matter and radiation are comparable. In this case β is neither equal to $1/3$ nor equal to 0, but a value in between 0 and $1/3$.The discussion of such models are significant in the sense that we have G and Λ as variable and the variations of G and Λ may be observable only on the time scale comparable to the age of the universe. Depending on the estimated data and observational data, we may construct the following three types of the cosmological models.

6.1. TYPE-I

Let us consider the following data

$$R = R_i = 10^{13} \text{ cm};$$

$$\rho = \rho_i = 10^{17} \text{ c.g.s. units};$$

$$G = G_i = 6.6 \cdot 10^{30} \text{ c.g.s. units};$$

$$\rho = \rho_0 = 3 \cdot 10^{-31} \text{ g} \cdot \text{cm}^{-3};$$

$$R = R_0 = 10^{28} \text{ cm} \tag{27}$$

with the help of the above equations and calculations we get

$$\alpha = 43/19, \quad \beta = 1/15 \ \& \ m = 56/15$$

and then we have

$$\frac{R^{28/15} dR}{\sqrt{A - kR^{56/15}}} = c dt. \tag{28}$$

For $k = 0$, the equation (28) is integrable under the conditions

$$R = 0, \quad t = 0.$$

For $k = 1$, If $R^{56/15} < A$

$$R < A^{15/56} = 10^{28} \text{ cm} = R_0.$$

If $R^{56/15} > A$

$$R > A^{15/56} = 10^{28} \text{ cm} = R_0$$

so we have

$$R = R_0 + \frac{15A}{82}\left(\frac{1}{R^{41/15}} - \frac{1}{R_0^{41/15}}\right) + \ldots$$

$$\ldots = c\,(t - t_0.) \tag{29}$$

6.2. TYPE -II

Let us consider the following data for construction of the model

$$R = R_i = 10^{13} \text{ cm};$$

$$\rho = \rho_i = 10^{17} \text{ c.g.s. units};$$

$$\Lambda = \Lambda_i = -10^{28} \text{ cm}^{-2};$$

$$G = G_0 = 6.6 \cdot 10^{-8} \text{ c.g.s. units};$$

$$\rho = \rho_0 = 3 \cdot 10^{-31} \text{ g} \cdot \text{cm}^{-3};$$

$$R = R_0 = 10^{28} \text{ cm}. \tag{30}$$

Then from the above equations we have

$$\beta = 1/15, \quad \alpha = 8/3 \ \& \ m = -11/3$$

and then for $k = 0$ under the conditions $R = 0$, $t = 0$

$$\frac{6}{17\sqrt{A}} R^{11/6} = ct \tag{31}$$

for $k = 1$.

If $R^{11/6} < A$ or $R < A^{6/11} = 10^{28}$ cm.

And if $R^{11/6} > A$ or $R > A^{6/11} = 10^{28}$ cm;

$$R - R_0 - \frac{3A}{16}\left(\frac{1}{R^{8/3}} - \frac{1}{R_0^{8/3}}\right) + \ldots =$$

$$= c\,(t - t_0)\,. \tag{32}$$

6.3. TYPE-III

Let us consider the following data for construction of the model

$$R = R_i = 10^{13} \text{ cm};$$

$$\rho = \rho_i = 10^{17} \text{ c.g.s. units};$$

$$\Lambda = \Lambda_i = -10^{28} \text{ cm}^{-2};$$

$$G = G_0 = 6.6 \cdot 10^{-8} \text{ c.g.s. units};$$

$$\rho = \rho_0 = 3 \cdot 10^{-31} \text{ g} \cdot \text{cm}^{-3};$$

$$R = R_0 = 10^{28} \text{ cm}; \tag{33}$$

$$G = G_i = 6.6 \cdot 10^{30} \text{ c.g.s. units};$$

$$\Lambda = \Lambda_0 = -10^{-57} \text{ cm}^{-2}.$$

Then after calculation we get

$$\beta = 2/45, \quad \alpha = 85/38 \ \& \ m = -517/141.$$

And then for $k = 0$ under the conditions $R = 0$, $t = 0$

$$\frac{282}{799\sqrt{A}} R^{799/282} = ct \tag{34}$$

for $k = -1$.

If $R^{517/181} < A$ or $R < A^{181/517} = 10^{28}$ cm.

And if $R^{517/181} > A$ or $R > A^{181/517} = 10^{28}$ cm. For $k = 1$:

$$R < A^{141/517} = 10^{28} \text{ cm}.$$

And hence the model is oscillatory; the approximate solution of the equation is given by

$$\frac{282}{799\sqrt{A}} R^{\frac{799}{282}} - \frac{141}{3666 A^{3/2}} R^{\frac{1833}{282}} + \ldots = ct. \tag{35}$$

7. CONCLUSION

In the present paper the possibility of constructing the cosmological models with $G\rho/\Lambda$ as constant have been discussed. The cosmological models in radiation dominated era, in matter dominated era and in the era when the matter and radiation are comparable are discussed separately. The exact solution is possible for flat models only, where as for close and open models exact solutions are not possible, which represents the realistic model of the universe. Therefore suitable approximate solution has been proposed. The flat model and the open model are ever-expanding models, whereas, the close model is an oscillatory model and there is a possibility of "missing mass" in the model.

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THE UNITED FORCES IN THE NATURE OF MATTER

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The united rest mass and charge of a particle correspond to two form of the same regularity of the unified nature of its ultimate structure. Each of them contains the electric, weak, strong and the gravitational contributions. As a consequence, the force of an attraction among two neutrinos and force of their repulsion must be defined from point of view of any of existing types of the actions. Therefore, to understand the nature of the micro world interaction at the fundamental level one must use the fact that each of the four well known forces includes in self both a kind of the Newton and a kind of the Coulomb components. The opinion has been speaked out that the existence of the gravitational parts of the united rest mass and charge implies the availability of the fifth force in the nature of matter.

In studying the fundamental structure of matter such characteristics as the mass and charge play a large role. At the same time their nature remains thus far not finally established. Usually it is accepted that there is no any connection between the mass and charge. However, according to the hypothesis of field mass based on the classical model of a hard electron [1], a particle all the mass is strictly electric.

Our analysis of the behavior of massive neutrinos in a nucleus field shows [2, 3] clearly that between the mass of a Dirac neutrino and its electric charge there exists an intimate interconnection. Such a sharp dependence giving the possibility to investigate the compound structure of charge quantization law [4] and reflects the fact that each of existing types of charges testifies in favor of the availability of a kind of the inertial mass [5]. Thereby this mass - charge duality of matter explains the coexistence of the united rest mass and charge for the same particle. At the account of earlier findings, nonweak [6, 7] and undiscovered properties of the neutrino they have the form [5]

$$m_\nu^U = m_\nu^E + m_\nu^W + m_\nu^S + ..., \tag{1}$$

$$e_\nu^U = e_\nu^E + e_\nu^W + e_\nu^S + ... \tag{2}$$

Here the indices E, W and S imply that both mass and charge of the neutrino contain as well as the electric, weak and strong components.

Exactly the same one can as the development of these sights include in the discussion the gravitational mass and charge. This procedure, however, meets with many problems. One of them states that the united rest mass of a particle contains the part that corresponds to its gravitational charge.

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In conformity with such contributions of the gravitational mass m_ν^G and charge e_ν^G, we not only recognize [8] that

$$m_\nu^U = m_\nu^E + m_\nu^W + m_\nu^S + m_\nu^G, \tag{3}$$

$$e_\nu^U = e_\nu^E + e_\nu^W + e_\nu^S + e_\nu^G \tag{4}$$

but also need elucidate what neutrino united rest mass and charge say about the unified force in the nature of matter. The answer to this question one can obtain by studying the ideas of each of existing types of charges and masses. All they therefore will be illuminated in the present work.

According to our presentations about the structural properties of rest mass and charge, the force of gravity of the Newton $F_{N_{\nu\nu}}$ among two neutrinos and force of the Coulomb $F_{C_{\nu\nu}}$ between themselves may also be expressed from point of view of any of all possible types of the actions. In other words, each of these forces becomes the function as well as of corresponding components of the united masses or charges of interacting objects.

One can define their structure in the limit of the electric masses and charges as follows [5]:

$$F_{N_{\nu\nu}}^E = G\left(\frac{m_\nu^E}{R}\right)^2, \quad F_{C_{\nu\nu}}^E = \frac{1}{4\pi\epsilon_0}\left(\frac{e_\nu^E}{R}\right)^2, \tag{5}$$

where G is the constant of the gravitational action.

These forces for the weak masses and charges may have the form

$$F_{N_{\nu\nu}}^W = G\left(\frac{m_\nu^W}{R}\right)^2, \quad F_{C_{\nu\nu}}^W = \frac{1}{4\pi\epsilon_0}\left(\frac{e_\nu^W}{R}\right)^2. \tag{6}$$

At the availability of strong masses and charges they must behave as

$$F^S_{N_{\nu\nu}} = G\left(\frac{m^S_\nu}{R}\right)^2, \quad F^S_{C_{\nu\nu}} = \frac{1}{4\pi\epsilon_0}\left(\frac{e^S_\nu}{R}\right)^2. \tag{7}$$

The contributions explained by the gravitational masses and charges of interacting particles are written in the form

$$F^G_{N_{\nu\nu}} = G\left(\frac{m^G_\nu}{R}\right)^2, \quad F^G_{C_{\nu\nu}} = \frac{1}{4\pi\epsilon_0}\left(\frac{e^G_\nu}{R}\right)^2. \tag{8}$$

In a similar way the studyied forces may also be defined for the united masses and charges:

$$F^U_{N_{\nu\nu}} = G\left(\frac{m^U_\nu}{R}\right)^2, \quad F^U_{C_{\nu\nu}} = \frac{1}{4\pi\epsilon_0}\left(\frac{e^U_\nu}{R}\right)^2. \tag{9}$$

Comparison of (9) with the corresponding size from (5) - (8) leads us to the consequence of correspondence principle that

$$F^U_{N_{\nu\nu}} = F^E_{N_{\nu\nu}} + F^W_{N_{\nu\nu}} + F^S_{N_{\nu\nu}} + F^G_{N_{\nu\nu}}, \tag{10}$$

$$F^U_{C_{\nu\nu}} = F^E_{C_{\nu\nu}} + F^W_{C_{\nu\nu}} + F^S_{C_{\nu\nu}} + F^G_{C_{\nu\nu}}. \tag{11}$$

Insertion of (3) and (4) in (9) it would seem says of that equations (10) and (11) do not correspond to the reality at all. It is easy to observe, however, that this is not quite so. The point is that any particle with the united mass and charge come forwards in the system as the unified and the whole. Nobody is in force to separate its by part in the mass or charge type dependence.

Furthermore, if it turns out that just the compound structures of the united rest mass and charge establish the intraneutrino harmony of forces of the different nature [9], this can also confirm the fact that m^U_ν and e^U_ν are the multicomponent vectors, squares of which become equal to

$$|\vec{m^U_\nu}|^2 = (m^E_\nu)^2 + (m^W_\nu)^2 + (m^S_\nu)^2 + (m^G_\nu)^2,$$

$$|\vec{e^U_\nu}|^2 = (e^E_\nu)^2 + (e^W_\nu)^2 + (e^S_\nu)^2 + (e^G_\nu)^2$$

and that, consequently, the existence of solutions (10) and (11) is by no means excluded naturally.

The absence of one of forces $F_{N_{\nu\nu}}$ or $F_{C_{\nu\nu}}$ would imply that both do not exist at all [5]. This becomes possible owing to the mass - charge duality of matter. In other words, $F_{N_{\nu\nu}}$ and $F_{C_{\nu\nu}}$ correspond to the most diverse form of the same action at the different distances.

According to the recent presentations about the nature of strong matter, the nuclear forces at a small distances have the character of the repulsion. In a large distances dependence can essentially appear their property of an attraction. Taking into account these facts and all what neutrino masses and charges say about structures of fundamental forces, we are led to the implication that each of them includes in self those parts which correspond to the masses and charges of interacting objects. Formulating more concretely, one can write the electric $F^E_{\nu\nu}$, weak $F^W_{\nu\nu}$, strong $F^S_{\nu\nu}$ and the gravitational $F^G_{\nu\nu}$ forces of the interaction between the particles in general form:

$$F^E_{\nu\nu} = F^E_{N_{\nu\nu}} + F^E_{C_{\nu\nu}}, \tag{12}$$

$$F^W_{\nu\nu} = F^W_{N_{\nu\nu}} + F^W_{C_{\nu\nu}}, \tag{13}$$

$$F^S_{\nu\nu} = F^S_{N_{\nu\nu}} + F^S_{C_{\nu\nu}}, \tag{14}$$

$$F^G_{\nu\nu} = F^G_{N_{\nu\nu}} + F^G_{C_{\nu\nu}}. \tag{15}$$

So, it is seen that any of the four well known forces contains both a kind of the Newton and a kind of the Coulomb parts. In this the unified regularity is said of the nature of these forces. Therefore, to create at the fundamental level a truly picture of the micro world interaction one must establish the compound structures of their naturally united gauge potentials.

If now the idea of any of forces (9) is accepted, it should be added that

$$F^U_{\nu\nu} = F^U_{N_{\nu\nu}} + F^U_{C_{\nu\nu}}. \tag{16}$$

Using (10), (11) and taking (12) - (15), we find that

$$F^U_{\nu\nu} = F^E_{\nu\nu} + F^W_{\nu\nu} + F^S_{\nu\nu} + F^G_{\nu\nu}. \tag{17}$$

Thus, it follows that if the gravitational rest mass and charge of a particle are unequal to its all the mass and charge, this will indicate to the existence of the fifth force of the interaction which come forwards in the nature as the unified and the united.

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EXPERIMENT ON MEASUREMENT OF DEVIATION OF A LIGHT BEAM DIRECTED TO THE EARTH CENTER

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For the first time permanently acting regular deviation of a light beam (about $8'' \pm 0.86$ angular seconds) directed "downwards" to the Earth center was experimentally revealed and measured. Theoretical and experimental data testifying the observed phenomenon are presented. The degree of influence of different factors on deviations of a light beam achieving more than $40''$ per month is specified. The diagram of deviations that took place every 3 hours in course of 31 days is constructed.

1. Theoretical basis and experimental presuppositions of the experiment

In practice measurement of vertical angles (for example, in geodesy) are always accompanied by a correction "for refraction" calculated using the refraction coefficient - k. The refraction coefficient is a rather constant value with small (rarely up to 30 %) deviations weakly dependent upon meteorological conditions. Now the average refraction coefficient is considered equal approximately to 0.14. In the 18^{th} and 19^{th} centuries it was assumed equal to 0.16 [1]. Influence of casual deviations of the refraction coefficient from its average value is supposed to be decreased only by means of choice of a period (allegedly the best) of a day and quantity of days when measurements are performed. Measurements exceeding a certain threshold are rejected and additional measurements are carried out. It is found out that during measurements on average frequently used distances (2-5 km) the refraction coefficient can be expressed through the angular value: about $7.5''$ angular seconds.

In 1980 the experiment aimed at detecting (relative) casual non-refractive deviations of a light beam from the plane close to the horizontal one was performed. Experiment proceeded within three day without breaks and with registration of readings every 30 minutes. Casual deviations of a light beam (amplitude was about $20''$) that took place in course of a day were observed. In the same period two experiments with a mobile variant of the measuring instrument, were carried out: in a lift of a 12-floor building and on small hydrographic vessel. Adequate "reaction" of a light beam to the inertial influences during lift accelerations, ship turnings and wave affects was registered. In the lift, for example, the deviation of a light beam exceeded ± 10 angular minutes of corresponding direction in the beginning of elevation and in the beginning of descent.

Analysis of all preliminary investigations of a light beam deviation showed detection and measurement of the "absolute" deviation required measurements in course of a long period using statistical processing of the received results.

2. Unique equipment (bilateral plane-parallel mirror)

Search of a possibility to measure "absolute" (relative to a horizontal plane) deviations of a light beam resulted in the only possible (the author's opinion) decision - construction of a unique bilateral plane-parallel mirror. The mirror designed and constructed in 1983 has a form of a glass disk with the diameter 150 mm and thickness 20 mm. The main aim in the mirror construction was ensuring of maximum parallelism of its two planes. The results of tests of the instrument (quality department of one of the enterprises in Kazan') showed that the author achieved divergence of the mirror planes of about 2". The mirror ratings are: $NA = 0.2$(rings), $\Delta NA = -0.2$, $NB = 0.2$, $\Delta NB = -0.2$ and $Q = 2''$. In a point of the disk largest thickness there is a hairline permitting to orientate the axis of the mirror revolution in such a way that influence of non-parallelism is minimal.

The mirror is set on a stand that allows its inclination "to a theodolite" at a given optimum angle. In the given case the inclination of the mirror relative to the vertical was prescribed to be about 3 angular minutes. The mirror stand was another (less accurate) theodolite. Instead of the unscrewed objective, the mirror was

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installed without any fastenings. The stand permitted to rotate the mirror around the vertical axis coinciding with the vertical that passed through the geometrical center of the glass disk. In so doing the inclination angles of both sides of the mirror were symmetric relative to the horizon and oppositely focused. At absence of deviations of a light beam, this factor could make results of measurements on two sides of the mirror strictly identical over the module, but actually it is never observed.

3. Measuring instruments and the process of measurement of a light beam deviation

The device for measuring non-refractive deviations of a light beam consists of two basic parts: accurate goniometer - theodolite (T2 N109211, 1974) with a sighting target and a mirror (taking place opposite to it) in which reflections of the theodolite and the sighting target are observed. The distance between the rotation axes of the theodolite and the mirror is 1.52 m that is close to a focal length of the used optics. The sighting target is made of a kapron thread of white color (its thickness is about 0.015 mm) that is fixed strictly horizontally in the center of the objective. Displacement of the sighting target "upward - downward" observed some time later in the theodolite's field of vision characterizes real deviation of a light beam and constitutes a subject of measurements. The device "theodolite - mirror" is orientated from the north to the south. The theodolite and the mirror were established on the stands used in geodetic works.

The process of measurement of light beam deviations implies twice-repeated registration of readings "circle - left" (Cl) and "circle - right" (CR) on each side of the mirror (sides I and II). In other words, one full set of measurements consists of four pointings of a grid crosshair of the theodolite on the mirror image of the sighting target (thread). After first two readings (the tube is transferred through zenith - CL and CR) carried out on one of the sides of the mirror, the latter turned on 180 degrees and the second pair of readings (CR and CL) on the other side of the mirror was registered. Specific value of a light beam deviation Ω in a certain moment of time consists in the algebraic half-sum of mean values of the angles on two sides of the mirror:

$$\Omega = (Im + IIm)/2.$$

Actual example of measurement and calculation of a light beam deviation (10.05.03; 9:00):

Every day at 12 a.m. "correction" of all levels of the theodolite and the stand to a zero "middle" position of bubbles of cylindrical levels was done according to the standard technique accepted in geodesy. To decrease mechanical affect upon the instruments and easing of loading on the operator, other measurements were carried out without "correction" of levels. Measurements were controlled by the difference of measurements on two circles. In the given example this difference Δ equals $50''$.

4. Sources of possible errors of measurements

Before the beginning of the experiment all artifacts were revealed and eliminated, possible errors depending on the design peculiarities of the instrument and influence of external conditions (physical fields) were investigated and possible measurement errors were estimated.

Influence of external conditions (physical fields) was studied during the already mentioned experiment (1980) on measurements of relative deviations of a light beam. Two systems "theodolite - mirror" (the distance between them is about 1.6 m) were installed mutually perpendicularly on a rain-forced concrete monolith of the official gravimetric station N 1768 (Sevastopol) in the room of constantly operating gravimetric laboratory. The following instruments were used: two thermographs, barograph, psychrometer, two commercially produced gravimeters "Delta" (N 443 and N 603) and special measuring magneto-electric equipment used at research (hydrographic) vessels. During continuous measurements (every 30 minutes) within 3 days (from December 3 till December 6, 1980), no noticeable correlation with none of known phenomena, except for variations of gravity acceleration was revealed.

Possible constructive (mechanical) affects on measurement accuracy were investigated directly before the experiment. "Drying" of wooden stands and "shrinkage" of all rubbing and rotating details were excluded by means of their "weathering" within a month and a half. At the same time all regular and additional tests and adjustments of the instruments including uniform distribution of lubrication of rotating details of the theodolite and mirror were performed. Affects of "distortions" (from optimal values) of the following parameters upon the measurements of angles of the light beam deviations were additionally determined:

- mirror height (by ± 0.6 cm);
- mirror incline (0–5 degrees);
- perpendicular position of a mirror and a transit line (± 5 degrees);
- thread displacements (± 2 mm);
- displacement of the mirror center from the axis of its rotation (by ± 2 mm).

The obtained mistakes were (separately) much less than $1''$ that permitted not to include them in the accuracy estimation (because of possible distortion of calculation symmetry).

Table 1: Results of measurement

	I		mean		Ω
Cr	$89°57'28''$	$+2'32''$			
			$+2'57''$		
Cl	$270°03'22''$	$+3'22''$			
		$\Delta = 50''$		$-38''/2$	$-19''$
	II				
Cl	$90°04'00''$	$-4'00''$			
			$-3'35''$		
Cr	$269°56'50''$	$-3'10''$			
		$\Delta = 50''$			

The general error of measurements of a light beam deviation consists of the following: mistakes in pointing on a sighting target, mistakes in registration of readings and those due to non-parallelism of the mirror sides. Theodolite T2 was used. Its error of measurements of directions in field conditions is about 2 angular seconds. In laboratory conditions with uniform electric illumination of the sighting target and noniuses of a theodolite and also at comfortable position of an operator ("sitting" position), the pointing error is considered to be 2-2.5 times smaller, i.e. it can be assumed $\pm 0.8''$. The error of readings by theodolite T2 in laboratory conditions is also $\pm 0.8''$ [2]. The error due to non-parallelism of the mirror sides was reduced to zero during the mirror orientation when the hairline on a glass disk was located on the diameter normal to the vertical axis of the mirror rotation. It permitted to use a rating error - $\pm 0.2''$. Thus the instrument error of measurements of one direction in our case makes $\pm 1.22''$. In connection with a twice-repeated measurement of a double value of a light beam deviation, the method of measurements and calculations in determination of Ω permits to reduce the obtained value by 1.41 times, i.e. probable value of $M\Omega$ is $\pm 0.86''$. As the expected light beam deviation is approximately $-8''$, $M\Omega$, being slightly more 10% of the sought value, can be considered accurate enough for reliable determination of constant deviation of the light beam.

5. Measurement laboratory and realization of the experiment

The laboratory was equipped in a concrete cellar (the area is about 3 m^2) in a two-floor building located far from transport highways. The nearest one was at the distance of about 300 m. Coordinates of the laboratory are $44°36'$ N and $33°28'$ E (Sevastopol). To illuminate the sighting target and to maintain constant temperature in the laboratory, one incandescent lamp (40 W) was used. It was located at the distance of about 1.5 m from the measuring instruments. The theodolite measuring scales were illuminated by one cylindrical (length is 30 cm) luminescent lamp of "cold luminescence" (15 W) located above the theodolite at the height of 30 cm. Both lamps were constantly switched on. During the breaks between observations the theodolite tube was covered by a light shutter protecting it from thermal radiation of lamps and possible dust loading. During the whole period of the experiment (31 days) constant humidity and practically constant temperature $+22.5 \pm 0.5°$ C preserved in a natural way.

After preliminary study and elimination of all the revealed artifacts on April 12, 2003 at 11:55 a.m. the experiment on measuring absolute deviations of a light beam began. It proceeded till May 12, 2003, i.e. up to the moment when the Moon passed the perigee point (May 12; 6:00; Greenwich).

Measurements were carried out every three hours, Kiev time (+ 2 hours to World time), continuously within 31 days by the only specialist - the author of the given work. It was already said that every day at 12:00 a.m. position of bubbles on all the levels was corrected by a standard method. The average value between the measurements before the correction and after it was assumed to be the most probable value of deviation at 12:00 a.m.

Strokes on the limb of the theodolite glass circle are put in 10 angular minutes. The scale factor of the reading device (covering the interval of 10 angular minutes) is equal to one angular second that permits to register readings with a visual estimation up to $0.1''$. In the given case the readings were registered with the rounding up to $1''$.

The life regime of the operator implied 1 hour of dream after every 3 hours.

6. Graph of deviations of a light beam and results of the experiment

Deviations of a light beam were measured 272 times, 31 of them were double ones at 12:00 a.m. when the average values were calculated. In total 241 values of

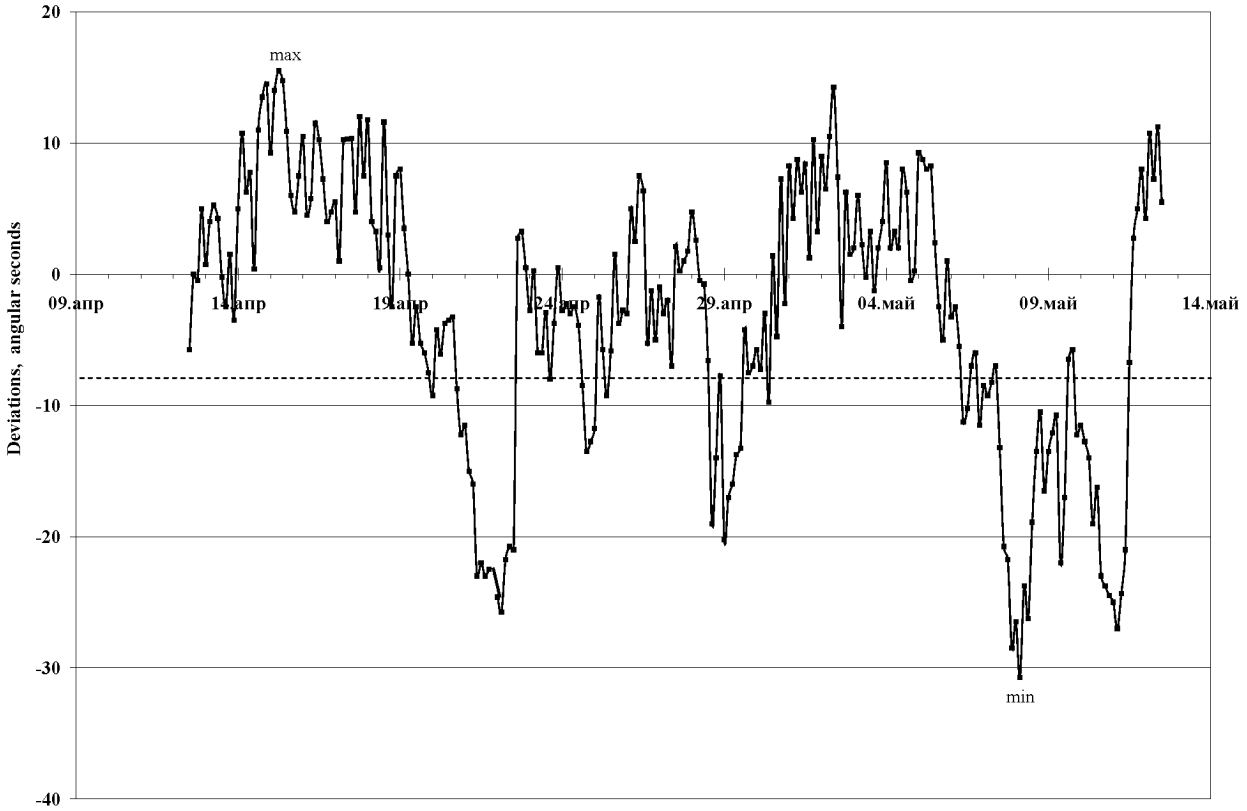

Figure 1: Dependence of a light beam deviation on the date measurements

the function were marked on the graph (every 3 hours).

It is well seen on the graph that extreme deviations of the beam - $max = +15.5''$ (15.04; 6:00) and $min = -30.75''$ (8.05; 3:00), being located near to the approximating curve, are not exceptions. It once again confirms a degree of verification of measurements.

Note that the periods between the extremums do not coincide with the Moon phases, however adequate connection with a sidereal (star) month is defined. For example, the period between two minimums $-25.75''$ (22. 04; 3:00) and $-20.25''$ (28.04; 24:00) makes 6 days and 21 hours. A quarter of a sidereal month is equal to 6 days and 20 hours. It may be regarded as the external (relatively the Earth-Moon system) influence upon a light beam. Besides, one can obviously observe the expected connection between the long-period (about 7 days) deviations of a light beam and the different periods of the anomalous month constituting 27 days, 13 hours and 18 minutes.

A form of the approximating curve is rather characteristic. It looks like an incorrect cycloid with sharp changes of a direction in the points of minimums and enough smooth transitions in the top positions of the curve.

After "standard" statistical processing of measurement data the following results were obtained:

- arithmetic-mean value of a light beam deviation (**A**) equals $-3.1''$;
- root-mean-square value of a light beam deviation (**K**) equals $\pm 10.43''$;
- Algebraic half-sum of extreme values (δ) equals $-7.6''$.

Taking into account that the root-mean-square value of the deviation (**K**) can be twice more important than the other ones, let us calculate the most probable value of constant deviation of a light beam directed "downwards":

$$\Omega = (A + 2K + \delta)/4 = -7.9'' \pm 0.86''.$$

7. Conclusions and recommendations

Thus, it can be stated with confidence that, except for sign-variable identified and casual deviations of a light beam, constant (regular) deviation of a beam along the vertical directed to the Earth center by the value of about $8'' \pm 0.66''$ angular seconds is revealed. The nature of this phenomenon is not yet clear. The reason of a light beam deviation is assumed to consist in the second space speed (11.2 km/s) that, being summed

up with the light velocity (Galilee), equals $-7.7''$. It practically coincides with the empirical value of the refraction coefficient and the result of the present experiment.

The performed experiment (and other ones since 1980) revealed the following fact: deviation of a light beam is subjected to the influence of not less than four factors, namely a constant regular deviation directed downwards (about $8''$), fluctuations of the Earth electromagnetic field, a gradient of the Earth acceleration at its motion relative to the perigee and apogee (a cycloid, from $-30''$ up to $+10''$) and cosmological wobble (with the amplitude up to $10''$ and the period from several minutes).

It should be stressed that the measurement of "absolute" deviations of a light beam in a vertical plane is done for the first time. It can mean development of principally new device intended for measuring cross effects in light distribution.

It is possible to increase sensitivity of the device (almost by an order) and to elaborate a modification of a mobile instrument to measure relative deviations of a light beam in horizontal and other planes. Besides a new device can be used as a gauge of inertial variations without application of gyroscopes. One should not exclude the opportunity to define and measure the parameters of presumably gravitational waves with "unnatural" periods, such as wobble.

Unequivocal quantitative confirmation of the effect requires additional experiments (synchronously in different places of the Earth) with separate consideration of the factors influencing a light beam. However it is necessary to take into account that during analogous experiments another distribution of deviations in time (with similar statistical result) will be observed. More over, rather significant (up to $50''$ and more) deviations of a light beam can be observed. It is conditioned by periodic coincidence of phases of several affects, i.e. by total effect. Besides, in the periods close to the Moon and Sun eclipses, anomalous (much more than $50''$) deviations of a light beam can be observed.

Note that presence of real deviations of a light beam with the amplitude of dozens of angular seconds does not exclude rather accurate scientific and technical measurements (for example, in astronomy and geodesy). The method of "relative" measurements and processing of such measurements developed and used in practice permits to consider empirically and to minimize periodically occurring "mistakes". But the opportunity to obtain continuous observations of a light beam deviation (in special laboratories) used as corrections of real measurements will provide a possibility to increase accuracy of field measurements and significantly decrease duration of such measurements.

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