ON THE SPATIAL VARIATION OF THE GRAVITATIONAL CONSTANT

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ABSTRACT

The analysis of movement of planets and satellites of Jupiter, Saturn, Uranus and Neptune has found out necessity of taking into account of the spatial variation of the gravitational constant of classical mechanics for the correct description of movement of space vehicles in Solar system.
The empirical law for calculation of an electrostatic field of planets that is in accordance with results of measurements of the electrostatic field on the surface of Earth is offered.

1. INTRODUCTION

On the basis of the new geometrical interpretation of the Third Kepler Law, which was developed in [1 – 3], we have shown that the gravitational radiuses of bodies are parameters, which are interpreting essence of the material world: they are testifying to the hypothesis of rotational nature of substance and of about the hierarchical structure of Solar system.

As shown in [3], the "resonant" expressions, similar to invariants for major planets of the Solar system that were found in [1,2] take place and for systems of satellites of Jupiter, Saturn, Uranus and Neptune. In [1,2] it is shown:

$$\sum_{k=1}^{9}\frac{2C}{T_k}\approx\sum_{k=1}^{9}g_k\approx\frac{g_{\otimes e}}{2}=\frac{C}{T_{\otimes e}},\ \Leftrightarrow\quad\sum_{k=1}^{9}\frac{1}{T_k}\approx\frac{1}{2T_{\otimes e}};\ \ g_{\otimes}\cong g_{\otimes e}\equiv\frac{2C}{T_{\otimes e}}\ .$$

Here C is the group velocity of light, $g_{\otimes}$ is the acceleration of free falling on a surface of the Sun, $g_{\otimes e}$ is the “gravitational field” of the Sun in equatorial area of its surface, $T_{\otimes e}$ is sidereal equatorial period of rotation of a points of Sun’s surface corresponding to heliographic latitude B in interval $-16^{\circ}\le B\le+16^{\circ}$, g_k are the accelerations of free falling on a surfaces of major planets and T_k are periods of rotation of major planets of Solar system around the Sun, $k=1,2,3,4,5,6,7,8,9$.

Really, if parameters g_k^*, $T_{\otimes,k}^*$ and R_k^* will be introduced into consideration by means of expressions:

$$2\cdot\sum_i\frac{2C}{T_{k,i}}\equiv\frac{2C}{T_{\otimes,k}^*}\equiv g_k^*\quad\Leftrightarrow\quad\sum_i\frac{1}{T_{k,i}}=\frac{1}{2T_{\otimes,k}^*};\qquad R_k^*\equiv\sqrt{\frac{\gamma m_k}{g_k^*}}\equiv C\sqrt{\frac{R_{k,g}^*}{g_k^*}};$$

Then, having made calculations R_k^* also $T_{\otimes,k}^*=2C/g_k^*$ is possible to be convinced of validity of the expressions, allowing to present gravitational radius of major planets of Solar system with expression similar to expression for gravitational radius of Sun $R_{\otimes g}$ that was found in [1,2]:

$$R_{k.g}=\frac{m_k\gamma}{C^2}\cong R_{k,gr}^*=\frac{2R_k^{*2}}{CT_{\otimes,k}^*};\qquad R_{\otimes g}=\gamma\frac{M_\otimes}{C^2}=\frac{2R_{\otimes e}^2}{CT_{\otimes e}}=1.4777\cdot10^5\,\text{см}\cdot$$

Here g_k^* is the acceleration of free falling on a surface that is corresponding to the certain radius R_k^*, which is going from the center of k - th planet with mass m_k and radius R_k, $R_{k,g}$ is the gravitational radius of k - th of planet, γ is the gravitational constant, $M_\otimes$ is Newtonian mass of Sun, $R_{\otimes g}$ is the gravitational radius of Sun.

Really, having executed the appropriate calculations for system of satellites of major planets of Solar system of the Jupiter, Saturn, Uranus and Neptune it is possible to show validity of the following expressions.

For the Jupiter:

$$\sum_{i=1}^{59}\frac{2C}{T_{5,i}}\cong1.025\cdot10^7\cong\frac{g_5^*}{2}\frac{\text{cm}}{\text{sec}^2};\ \Rightarrow g_5^*\cong2.05\cdot10^7\frac{\text{cm}}{\text{sec}^2};$$

$$T_{\otimes,5}^*=\frac{2C}{g_5^*}\cong2925\,\text{sec}<<T_{\otimes,5}\cong35430\,\text{sec};$$

$$R_5^*\cong786\cdot10^5\,\text{cm}<<R_5\cong71400\cdot10^5\,\text{cm};$$

$$R_{5,g}^*=\frac{2R_5^{*2}}{CT_{\otimes,5}^*}\cong140.9\,\text{cm}\cong R_{5,g}\cdot$$

For Saturn:

$$\sum_{i=1}^{37}\frac{2C}{T_{6,i}}\cong2.138\cdot10^7\cong\frac{g_6^*}{2}\frac{\text{cm}}{\text{sec}^2};\ \Rightarrow g_6^*\cong4.276\cdot10^7\frac{\text{cm}}{\text{sec}^2};$$

$$T_{\otimes,6}^*=\frac{2C}{g_6^*}\cong1402\,\text{sec}<<T_{\otimes,6}\cong36840\,\text{sec};$$

$$R_6^*\cong297\cdot10^5\,\text{cm}<<R_6\cong60400\cdot10^5\,\text{cm};$$

$$R_{6,g}^*=\frac{2R_6^{*2}}{CT_{\otimes,6}^*}\cong42.1\,\text{cm}\cong R_{6,g}\cdot$$

For Uranus:

$$\sum_{i=1}^{24}\frac{2C}{T_{7,i}} \cong 1.566\cdot 10^7 \cong \frac{g_7^*}{2}\frac{\text{cm}}{\text{sec}^2};\ \Rightarrow g_7^* \cong 3.132\cdot 10^7\ \frac{\text{cm}}{\text{sec}^2}\ ;$$

$$T_{\otimes,7}^* = \frac{2C}{g_7^*} \cong 1914\,\text{sec} << T_{\otimes,7} \cong 38940\,\text{sec}\ ;$$

$$R_7^* \cong 137\cdot 10^5\,\text{cm} << R_7 \cong 23800\cdot 10^5\,\text{cm}\ ;$$

$$R_{7,g}^* = \frac{2R_7^{*\,2}}{CT_{\otimes,7}^*} \cong 6.5\,\text{cm} \cong R_{7,g}\ .$$

For Neptune:

$$\sum_{i=1}^{12}\frac{2C}{T_{8,i}} \cong 0.806\cdot 10^7 \cong \frac{g_8^*}{2}\frac{\text{cm}}{\text{sec}^2};\ \Rightarrow g_8^* \cong 1.6\cdot 10^7\ \frac{\text{cm}}{\text{sec}^2};$$

$$T_{\otimes,8}^* = \frac{2C}{g_8^*} \cong 3720\,\text{sec} << T_{\otimes,8} \approx 54000\,\text{sec}\ ;$$

$$R_8^* \cong 206\cdot 10^5\,\text{cm} << R_8 \cong 22300\cdot 10^5\,\text{cm}\ ;$$

$$R_{8,g}^* = \frac{2R_8^{*\,2}}{CT_{\otimes,8}^*} \cong 7.6\,\text{cm} \cong R_{8,g}\ .$$

Here $T_{\otimes,k}^*$ is the period of rotation of invisible "surface" of k - th of planet, latent by its atmosphere, around its axis limited by radius $R_k^* \neq R_k$.

Thus, in systems of satellites and rings of " gas planets " Jupiter, Saturn, Uranus and Neptune, probably, there are some "resonant" conditions of existence of satellites of these planets and their invisible internal structures rotating with sidereal periods $T_{\otimes,k}^*$.

By taking into account, the magnitudes g_k^* are determined with the big set of periods of rotation of satellites around their planets $T_{k,i}$ and $R_{k,g}^* \cong R_{k,g}$, it is possible to suppose that probably, the parameter R_k^* defines radiuses of internal vortical formations of the planets being a latent internal part of invisible "surfaces" of the Jupiter, Saturn, Uranus and Neptune, which are latent by a gas environment and play a role similar to a role of ring formation of visible "surface" of the Sun in a range of heliographic latitudes $-16^\circ \le B \le +16^\circ$:

$$R_{k,g}^* = R_{k,g}\ ; \qquad \sum_i \frac{1}{T_{k,i}} = \frac{1}{2T_{\otimes,k}^*};\quad \propto \quad \sum_{k=1}^{10}\frac{1}{T_k} = \frac{1}{2T_{\otimes e}}\ .$$

Thus, the results of researches executed in [1,2,3] testify to gravitation dependence on the period of rotation of the Sun, planets and their satellites and therefore of about a possible variation of magnitude of magnitude of Newtonian gravitational constant in a vicinity of planets of Solar system.

According to results of the analysis executed in [2,3], magnitudes of gravitational radiuses of planets $R_{k,g}$ are mutually connected to magnitudes of an average velocities of their satellites and semi-major axes of their orbits, that is why

we have taken decision about performing the independent calculations of a gravitational constant γ_k in a vicinity of Jupiter, Saturn, Uranus and Neptune that are having a plenty of satellites for of checking up of validity of definition of a "gravitational constant" γ by the constant magnitude in the classical mechanics. The presented research also is devoted to studying of this question.

2.The ANALYSIS of DATA

2.1 The variation of gravitational constant

For the analysis of a probable variation of magnitudes of a gravitational constant γ in vicinity of major planets between the first belt of asteroids and the belt of Kuiper, we shall use of the theory of dimensions and we shall introduce into consideration the quantity

$$\gamma_k = \frac{C^2 R_{k,g}}{m_k}, \qquad (1)$$

Here $k = 0,1,2,....9..$ and for $k = 0$, $m_0 \equiv M_\otimes$, $R_{0,g} \equiv R_{\otimes g}$, $\gamma_0 \equiv \gamma_\otimes$ - gravitational constant in vicinity of the Sun.

Here in (1) gravitational radiuses of planets $R_{k,g}$ of Jupiter, Saturn, Uranus and Neptune that are having numerous satellites, are defined, as well as gravitational radius of the Sun $R_{\otimes,g}$, according to the expressions found in [2]:

$$R_{\otimes g} = \left[\frac{\sqrt{a_{k+1}} - \sqrt{a_k}}{\frac{C}{V_{k+1}} - \frac{C}{V_k}} \right]^2 ; \qquad R_{k,g} = \left[\frac{\sqrt{a_{k,i+1}} - \sqrt{a_{k,i}}}{\frac{C}{V_{k,i+1}} - \frac{C}{V_{k,i}}} \right]^2 . \qquad (2)$$

Here in expression (2) a_k and $a_{k,i}$ are semi major axes of orbits of k - th planets and of their i - th satellites accordingly; V_k are mean orbital velocities of k - th planets, $V_{k,i}$ are mean orbital velocities of i -th satellites of k - th planet, C is the group velocity of light.

Thus, magnitudes of gravitational radiuses of planets $R_{k,g}$ and gravitational radius of Sun $R_{\otimes,g}$ can be defined by means of using expressions (2) on the basis of direct measurements of semi major axes a_k, $a_{k,i}$ and of average orbital velocities of planets V_k and of their satellites $V_{k,i}$ believing that group velocity of propagation of energy of radiation C within of Solar system is the constant and C can be determined by expression $C \approx 2.9979246 \cdot 10^{10} \frac{\text{cm}}{\text{sec}}$ [2].

The researches of Solar system within the framework of mathematical model of the classical mechanics lead to definitions of gravitational radius of the

Sun $R_{\otimes g}$ and gravitational radiuses of planets $R_{k,g}$ and the gravitational constant γ in Solar system by means of expressions:

$$\gamma = \frac{C^2 R_{\otimes g}}{M_{\otimes}} \equiv \frac{1}{15} \cdot 10^{-6} \frac{\mathrm{cm}^3}{\mathrm{g\,sec}^2} = 6.6(6) \cdot 10^{-8} \frac{\mathrm{cm}^3}{\mathrm{g\,sec}^2}; \qquad (3)$$

$$m_k C^2 = \frac{\gamma m_k^2}{R_{k,g}} \;\Leftrightarrow\; C^2 R_{k,g} = \gamma m_k \;. \qquad (4)$$

By comparing expressions (3), (4) and (1) it is possible to be convinced that within the framework of model of Solar system described by means of classical mechanics, the parameter γ_k defined by expression (1) is formally identical the gravitational constant γ [1,2,3]:

$$\gamma_k = \frac{C^2 R_{k,g}}{m_k} \cong \frac{\gamma m_k}{m_k} = \gamma = const \;. \qquad (5)$$

Within framework of analysis fulfillment also it is necessary to do the following remarks concerning definition of γ in the classical mechanics.

The gravitational constant γ and mass coefficients m_k are defined in the classical mechanics in system of center of mass of the Sun and planets with use of Third Kepler Law in the formulation of Newton by the assumption that masses $m_{k,i}$ of i - th satellites of k - th planet there are less than mass of planet m_k.

In the mechanics of Newton mass of Earth is estimated on the basis of the analysis of perturbations of Moon by Earth. It complex task because problem is connected by with of no less complicated problem of definition of mass of Moon, which is solved within the framework of the classical mechanics by means of the analysis of perturbation of movement of the Earth by Moon in the assumption that Earth draws for one month around of the center of mass of the Earth and the Moon the elliptic trajectory. But in fact the measurements show that the trajectory of the Moon is very complex. The mass of Mercury is estimated by the method of perturbation theory also.

The result of calculation of parameter γ_k from expression (1) with of using (2) is presented in figure 1. Here number k changes from $k = 5$ appropriate for Jupiter, up to $k = 9$ for Pluto. The gravitational parameter $\gamma_9 \equiv \gamma$ in vicinity of Pluto is shown in figure 1 with the purpose of comparison of constant γ with magnitudes of gravitational parameters that are calculated in vicinities of Jupiter Saturn, Uranus and Neptune with of using magnitudes of their gravitational radiuses that are independently determined by means of using expressions (2).

As shown in figure 1, calculation of γ_k for planets has discovered a spatial variation of the gravitational constant.

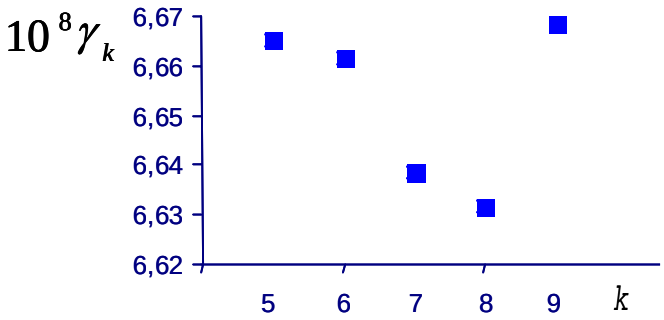

Fig.1 The variation of γ_k parameter in a vicinity of planets

The magnitude of the gravitational constant $\gamma_{\otimes}$ in a vicinity of the Sun that was found by means of using of expressions (1) and (2) has coincided with its traditional magnitude in the classical mechanics with high accuracy:

$$\gamma_{\otimes} = 6.6771769 \cdot 10^{-8} \cong \gamma = 6.6(6) \cdot 10^{-8} \frac{\text{cm}^3}{\text{g sec}^2}$$

The result of calculation of parameters γ_k in vicinities of Jupiter, Saturn, Uranus and Neptune is looking extraordinary, but we don't have of real base for doubts, because gravitational radiuses of planets $R_{k,g}$ of this group, as well as gravitational radius of the Sun $R_{\otimes,g}$, are calculated with of using all plenty of their known satellites according to the expressions (2), which were received in [2].

The discovered effect of a spatial variation of the gravitational constant in vicinities of planets is significant and undoubtedly represents practical interest at fulfillment of the special analysis of concrete flight data of space vehicles to planets of Solar system by experts on astrometry and space navigation. We shall notice, that the appropriate effect of unexpected change of velocity of flight of space vehicles at approach to planets undoubtedly already repeatedly was observed.

On the basis of the carried out analysis it is possible to suppose that variation of the gravitational constant in vicinities of Jupiter, Saturn, Uranus and Neptune should be taken into account at calculations of time of flight of space vehicles in relative vicinity and of another massive space objects.

It is possible to show that navigation errors of the space vehicles on scales of interplanetary distances, which are connected with a variation of a gravitational constant, can run up to more than of hundreds of thousands kilometers. However the most important conclusion, which should be made, undoubtedly, consists in scientific necessity of realization of complex of measurements of spatial variation of gravitational constant in Solar system by means of using of accelerometers because we ought to remember that forces divine, diabolical or physical always present something of real cause of that we don't know.

2.2 On the mathematical formalism of the description in the classical models of body's interaction.

The reasonable mathematical description of a concrete natural phenomenon always reflects the description of its manifestation in concrete conditions of observation. The Universe "is invented" obviously not by us, that is why the speculative models in which the basic place occupies by of " mental experiment ", by of an axiomatics that are constructed virtually basically on representations of their authors about of reality of the Universe that in fact is unknown to them, sooner or later, always are discovering of them untenableness, when empirical knowledge of mankind are growing.

The conclusion rules of theorems in axiomatics that are used for interpretation of natural phenomena and, in part, rules of transforming of expressions in formal systems, by figuratively speaking, are the soul of formal systems of naturally scientific theories, because at any arbitrary definition of a conclusion rules in formal mathematical systems there is no hope for successful interpretation of repeatedly observable, well known natural phenomena. Therefore, if to take into account the unity of all phenomena of nature, it is possible to suppose that successful practice of using of traditional rules of transforming of formulas for various laws of a nature that are describing by formally identical models, is evidence of likeness of nature of the these phenomena that probably are reflecting the different properties of the same essence.

Formally identical models of Newton and Coulomb describe gravitational and electric interactions of bodies.

By considering expression for gravitational factors γ_k in a vicinity of the planets, being some analogue of gravitational constant γ of Newton's theory, it is possible to pay attention to that circumstance that, if we will multiply by mass factor m_k of Newton's theory both numerator and denominator of expression (1), the factors γ_k can be presented as ratio:

$$\gamma_k = \frac{m_k C^2 R_{k,g}}{m_k^2} \equiv \frac{Q_k^2}{m_k^2}. \qquad (6)$$

Here in numerator of expression (6) magnitude Q_k has dimension of an electrostatic particle charge that is appearing in Coulomb's Law.

Within the framework of model of the mechanics of Newton gravitational factor is taking in a form of constant $\gamma = const$ and consequently expression (6) in a vicinity of bodies A and B within the framework of the classical mechanics may be presented by means of equality:

$$\sqrt{\gamma} \equiv \frac{Q_A}{m_A} \equiv \frac{Q_B}{m_B} \approx \sqrt{\gamma_k}. \qquad (7)$$

By means of using (7) and rules of transforming of formulas of traditional algebra, it is easy to show that Newton's force F of interaction of bodies A and B can be presented by expression:

$$F = \gamma \frac{m_A m_B}{\rho^2} = \frac{Q_A Q_B}{\rho^2}. \qquad (8)$$

Here ρ is distance between bodies A and B, at the left part the expression (8) describes the Newton's Law of gravitation of bodies with mass m_A and m_B, and the right part of the expression (8) formally represents the Coulomb's Law of interaction of bodies with electrostatic charges Q_A and Q_B.

The necessary condition of fulfillment of the Third Kepler Law consists in presence of areas of a field of vacuum at inner parts of planets and of Sun that are limited by their gravitational radiuses; these areas are containing gravitation energy that can be formally estimated by equalities similar to Einstein's equation $E_k = m_k C^2$ [1,2,3]:

$$E_g = m_k C^2. \qquad (9)$$

In accordance to expressions (6) and (8), all gravitational energy of the planet E_g that has been presented by expression (9) by means of geometrical interpretation of Third Kepler Law[1,2,3], can be formally presented by means of the expression for electrostatic energy of a body E_{el} at the same area that is restricted by gravitational radius $R_{k,g}$, within the framework of model of interaction of bodies that are possessing of Coulomb's charge factors Q_k, by means of expression:

$$E_{el} \equiv \frac{Q_k^2}{R_{k,g}} \equiv m_k C^2 \equiv \frac{\gamma_k m_k^2}{R_{k,g}} \equiv E_g \quad \Leftrightarrow \quad Q_k = \sqrt{m_k C^2 R_{k,g}}; \quad \gamma_k = \frac{Q_k^2}{m_k^2}. \qquad (10)$$

Let's take into consideration the following quantities $E_{gA} = m_A C^2$, $E_{gB} = m_B C^2$, $E_{elA} = \frac{Q_A^2}{\rho}, E_{elB} = \frac{Q_B^2}{\rho}$ that are presenting accordingly: gravitational energy of a body A, gravitational energy of a body B, electrostatic energy of a body A and electrostatic energy of a body B and then, by means of using (10), we'll transform (8) to equality:

$$F = \gamma \frac{m_A m_B}{\rho^2} = \frac{m_A C^2 \gamma m_B^2}{m_B C^2 \rho^2} = \frac{m_A C^2 \frac{Q_B^2}{\rho}}{m_B C^2 \rho} \equiv \frac{E_{gA} E_{elB}}{E_{gB}} \frac{1}{\rho} = \frac{E_{gB} E_{elA}}{E_{gA}} \frac{1}{\rho}. \qquad (11)$$

By means of using expression (11) it is possible to show that conditions, when mass of body A are comparable to mass of body B and accordingly gravitational energies of bodies A and B are equal $E_{gA} \cong E_{gB}$, in expression for force of Newton

F in (11) there are staying only expressions E_{elA} and E_{elB}, which are formally describing electrostatic properties of bodies A and B accordingly:

$$F \cong \frac{E_{elA}}{\rho} \quad \text{for} \quad E_{gA} \cong E_{gB},\ E_{elA} \neq E_{gA}; \tag{12}$$

$$F \cong \frac{E_{elB}}{\rho} \quad \text{for} \quad E_{gA} \cong E_{gB},\ E_{elB} \neq E_{gB}. \tag{13}$$

At conditions, when electrostatic and gravitational components of energies of body A or of body B are equal, force of Newton F are defined exclusively by means of its gravitational energy:

$$F = \frac{E_{gA}}{\rho} = \frac{E_{gB}}{\rho} \quad \text{for} \quad E_{gA} = E_{elA}\ ;\ E_{gB} = E_{elB}. \tag{14}$$

2.3 The hypothesis of the Law of equal distribution of gravitational and of electrical energies of planets

Notice, when we was performing formal transformations at expressions (8), (10), (11), (12), (13), (14) we were making it outside of the frameworks of interpretation of the classical mechanics and of theory of electrostatics, where both the empiric Law of gravitation of Newton, the empiric Law of interaction of charged bodies of Coulomb are appearing as axioms of the appropriate theories. Nevertheless, taking into account equalities (12), (13) and (14), it is possible to put forward a hypothesis, that Newtonian gravitational and Coulomb's electrostatic models of interaction of bodies describe various properties of the same essence of interaction of bodies and to fulfill verification of this hypothesis, using exclusively results of empirical researches.

By taking into account analysis performed in [2,3], in accordance with result of which the geometrical interpretation of the Third Kepler Law is showing that condition of its realization discover of existence of compact field vacuum regions of energy at planets and at the Sun, of areas restricted in central parts of planets and Sun by means of theirs gravitational radiuses, we may suppose birth at these areas not only of a gravitational field but also an electrostatic field χ_k by means of some unknown way, according to the law that is acting at depth of planets and the Sun up to some radial distance ρ from their center and which is describing expression:

$$\aleph_k = \frac{Q_k}{\rho^2}. \tag{15}$$

Here Q_k represents effective electric charge of areas limited to gravitational radiuses of planets and the Sun <u>defined by us</u> within the framework of a hypothesis about equal distribution of gravitational and of electric energies:

$$Q_k \equiv m_k\sqrt{\gamma_k} \equiv \sqrt{m_k C^2 R_{k,g}}\,; \quad \Leftrightarrow \quad E_{el,k} \equiv \frac{Q_k^2}{R_{k,g}} = m_k C^2 \equiv E_{g,k}\,; \quad E_{el,k} + E_{g,k} = 2m_k C^2\,. \qquad (16)$$

By assuming that both magnitude of electric energy $E_{el,k}$ of k - th body and magnitude of gravitational energy $E_{k,g}$ of k - th body are generated basically in the region that is limited by their gravitational radius and moreover, the magnitudes of these components of energy of anyone k - th bodies are equal, we put forward the hypothesis about the law of equal distribution of energies, which are responsible for origin of gravitational and electrostatic fields inside the area limited by gravitational radius of a body.

The results of analysis that are presented in the following paragraph were performed with the purpose of research of applicability of the prospective Law of equal distribution of gravitational and of electric energies for the description of an electrostatic field χ_k on the surface of the Earth.

2.4 The electric fields on the surfaces of planets

Nowadays nobody knows the real internal structure of the Sun, of planets of Solar system and their satellites, including the structure of the Earth. Nevertheless, attempts of construction of logic virtual models of an internal structure of the Earth are undertaken. These models are confirmed by results of empirical investigations and of indirect interpretations of researches of the structure of the Earth up to depths of the order $3000\,\text{km}$. The presentation about these models gives us the drawing of figure 2.

The researches of a structure of the Earth, except of direct physical penetration into of its depth, mainly are based on results of measurement of propagation of seismic waves of a natural and artificial origin. There are performing of registration of longitudinal infrasound waves with displacements of particles of substance along the direction of propagation of a wave and the transversal seismic waves with displacements of particles along of the direction that is perpendicularly to a direction of their propagation. The measurements are interpreted taking into account that group velocity of longitudinal seismic waves more than of transversal seismic waves. Besides as against longitudinal seismic waves transversal seismic waves are not creating resistance for transversal displacements of particles in gaseous and liquid environments and because of this circumstance these waves have no possibility for propagation in gaseous and liquid mediums. These properties of seismic waves has formed the basis for statements about the substance of the Earth in accordance to which the substance of the Earth, probably, is in the fused liquid condition on depths more than $3000\,\text{km}$.

In 1909 the Yugoslavian seismologist A.Mohorovichich (1857-1936) has discovered phenomena of quick growing of the velocity of longitudinal seismic

waves on depth of $40\,\text{km}$ from approximately $7\,\text{km/sec}$ up to $8\,\text{km/sec}$ in accordance with probable change of density of substance from $2.9\,\text{g/cm}^3$ up to $3.5\,\text{g/cm}^3$. The interior surface of Earth on depth $40\,\text{km}$, where the abrupt changing of density of substance of the Earth is taking place, is named in honor of its discoverer by Mohorovichich's surface. It is assumed the surface of Mohorovichich is presenting the border of the firm part of the surface of the Earth: the area is higher than surface of Mohorovichich has been named “the crust”; the lower area is named “the mantle”. It is supposed the mantle has "pockets" full of fused liquid medium; pockets forms extensive underground lakes of liquid lava in regions of volcanoes, crust sometimes is breaking and it results in eruption of lava and by earthquakes on a surface of the Earth.

It is known that in mines the average gradient of growing temperature into depth is $20\,^0/\text{km}$; estimations of temperature of substance in depth at the linear extrapolation of its with such gradient have shown, the temperature in the central part of the Earth probably could be of the order of $100\,000\,^0\text{K}$ at conditions, when pressure more than one million technical atmosphere. That is why, by taking into account, that upper part of planet is in a firm condition and consequently temperature of upper part of planet can not exceed a melting point of its substances, we suppose nowadays that temperature at depth of the Earth on border of its firm and liquid parts, where pressure achieves $1300\,000$ technical atmosphere, does not exceed $5000\,^0\text{K}$. By traditionally believe that in the central area of the Earth probably there is a firm central part of a nucleus of the Earth that is limited to area with radius approximately $1300\,\text{km}$ and that in the external part of a nucleus, between the mantle and a firm nucleus, in the region that is limited by the radius equal approximately $3400\,\text{km}$, the substance is in a liquid condition; the temperature of nucleus of Earth is not exceeding $10\,000^0\text{K}$ and a density of substance of nucleus of Earth is growing approximately from $9.4\,\text{g/cm}^3$ up to $18\,\text{g/cm}^3$ [4].

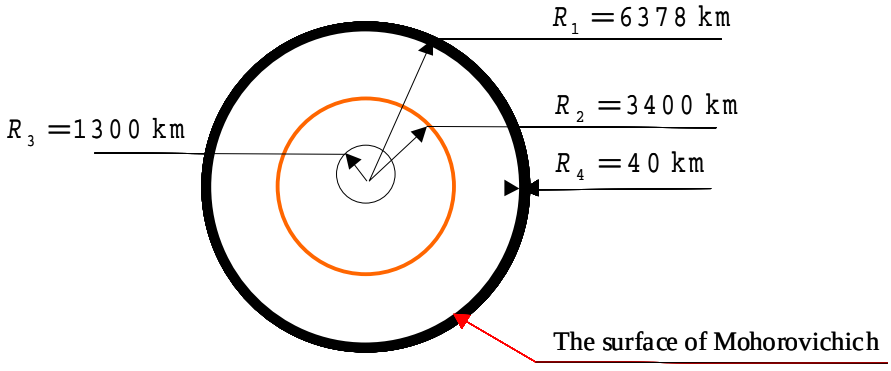

Fig.2 Traditional representation about a structure of the Earth

The assumption of existence in the center of the Earth of area of a firm nucleus contradicts results of the analysis of dynamics of movement of planets and

their satellites on the basis of which in [2,3], the geometrical interpretation of Third Law Кеплера (17) is given.

$$\frac{C}{V_k} = \sqrt{\frac{a_k}{R_{c,gr}}}\,. \qquad (17)$$

In accordance to (17), at a presence of substance in the region that is limited by gravitational radius $R_{c,gr}$ in the central area of a planet, the substance would have the speed that is exceeding group velocity of radiation of energy C higher of which nobody was observing ever within of Solar system, as out from equation (17) follows:

$$a_k \to R_{c,gr} \quad \Rightarrow \quad V_k \to C\ . \qquad (18)$$

Besides we shall remark that in conditions of floating of a hypothetical firm part of a nucleus with the high density of substance that is estimating by the magnitude of the order $14\,\mathrm{g/cm^3}$, in its liquid external area, the centrifugal forces caused by orbital movement of the Earth, probably, would displace its position concerning an internal surface of a mantle of a planet and probably could destroy a firm environment of the Earth or, at least, could change the ellipsoidal form of the Earth considerably.

By traditionally believe [5] that as a whole the Earth electrically is neutral, and the electric field that is observing on our planet in its firm body, in the seas and oceans, an atmosphere and magnetosphere, in a vicinity of the Earth in interplanetary space is caused basically

-By the radiation of the Sun that is falling on an ionosphere, an atmosphere and a firm surface of the Earth,

-By radiation of radioactive elements in an atmosphere of a planet on its surface and in its depths,

-By atmospheric processes of division of electrical charges under formation of clouds and of rain,

-By generation of electrical force that is arising because of difference of potentials at contacts.

In this connection we shall note, the generation of electric fields in an atmosphere by means of division of charges at formation of clouds and rain, can not take place, if there will be no originally a radial electric field of the Earth which is observed and in a circumterraneous of space, achieving intensity of several tens $\mathrm{mV/m}$. Besides we ought to remark that atmosphere is charged negatively concerning the surface of the Earth, but on average the rain which is falling out on its surface, brings positive charges approximately in $1.1-1.4$ time more, than of negative ones, and the measurements of an electric field on a surface

of the Earth in conditions of dry air discover on average the presence of an electric field with magnitude that equals approximately $130\,\mathrm{V/m}$ [5].

If to take into account that there is obvious discrepancy of the traditional model of a structure of the Earth and of the Third Kepler Law, it is possible to come to the conclusion the substance have been created probably on the border of gravitational radius of planets, where all atoms of the table of Mandeleyeyv are born and the nuclear reactions take place[2,3]: atoms of substance are various vortical structures of field of vacuum, which have been blown off to some surface by centrifugal forces where they have sticked together and thus these particles probably have formed surface of Earth which is created similar to a shell. We ought to take into account that Universe is invented not by us and we know about World in which we live, very little.

Therefore we had made attempt to estimate intensity of an electric field χ_k of a surface of the Earth within of model in which the Earth is represented by rather thin covering filled by medium that possesses by coefficient of electric permeability of order 1: we have calculated the magnitude of an electric field, which would be created in vacuum by a hypothetical electric charge Q_3 in depths of the Earth on distance that equals to radius of the Earth $R_3 = 6378\,\mathrm{km}$, by means of using expressions (15) and (16).

By means of using expressions (15) and (16) it is possible to be convinced the magnitude χ_3 is approximately equal to magnitude of the electric field $130\,\mathrm{V/m}$ that is measured on a surface of the Earth:

$$\chi_3 = \frac{Q_3}{R_3^2} \approx 3.8083 \cdot 10^6 \,\frac{\text{units CGSE}}{\text{cm}} \cong 126.94 \,\frac{\text{V}}{\text{m}}. \qquad (19)$$

By means of using (19) it is possible to explain result of calculation if to accept - the depths of our planet are filled with substances, which have coefficient of permeability for an electrostatic field, at an average from the center of the Earth up to its crust, of order 1. It means in turn - the representations about a firm nucleus of consisting of heavy elements of the table of Mandeleyeyv in the center of the Earth, with a high probability does not correspond to the reality. We shall emphasize here in addition once again: the representation about the central firm nucleus at depth of planets contradicts of the Third Kepler Law.

We supposed, that the nature of planets in Solar system, probably, has the general properties and calculations of electrostatic fields on surfaces and of other major planets of Solar system were made. The electrostatic field for "gas" planets is calculated for the internal surfaces with radiuses $R_5^*, R_6^*, R_7^*, R_8^*$ that are similar to the visible surface of the Sun.

for planet Jupiter at $R_5^* \cong 786 \cdot 10^5\,\mathrm{cm} << R_5 \cong 71400 \cdot 10^5\,\mathrm{cm}$;

for planet Saturn at $R_6^* \cong 297 \cdot 10^5\,\mathrm{cm} << R_6 \cong 60400 \cdot 10^5\,\mathrm{cm}$;

for planet Uranus at $R_7^* \cong 137 \cdot 10^5 \text{ cm} << R_7 \cong 23800 \cdot 10^5 \text{ cm}$;

for planet Neptune at $R_8^* \cong 206 \cdot 10^5 \text{ cm} << R_8 \cong 22300 \cdot 10^5 \text{ cm}$.

The result of calculations of field χ_k for planets of terrestrial group is presented on Fig. 3, where numbers k from 1 up to 4 accordingly belong to planets Mercury, Venus, Earth and Mars. The result of calculation of a field χ_k for planets of external group is shown on Fig.4, where numbers k from 5 up to 9 accordingly belong to planets Jupiter, Saturn, Uranus, Neptune and Pluto.

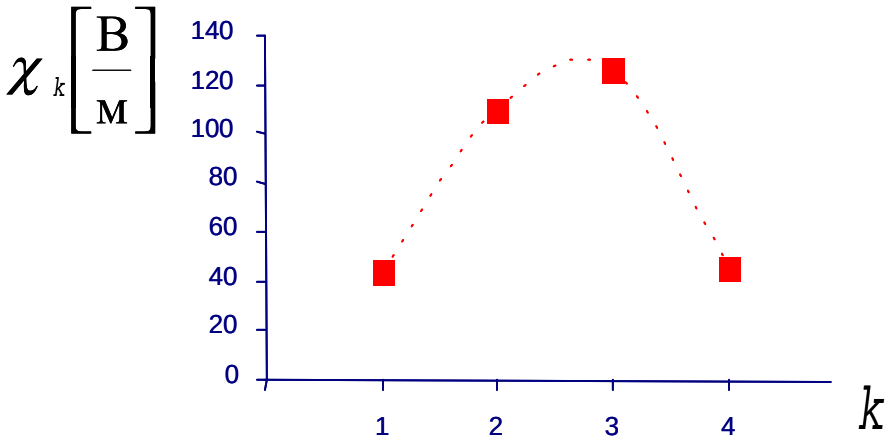

Fig.3 The electric field χ_k on a surface of planets of terrestrial group

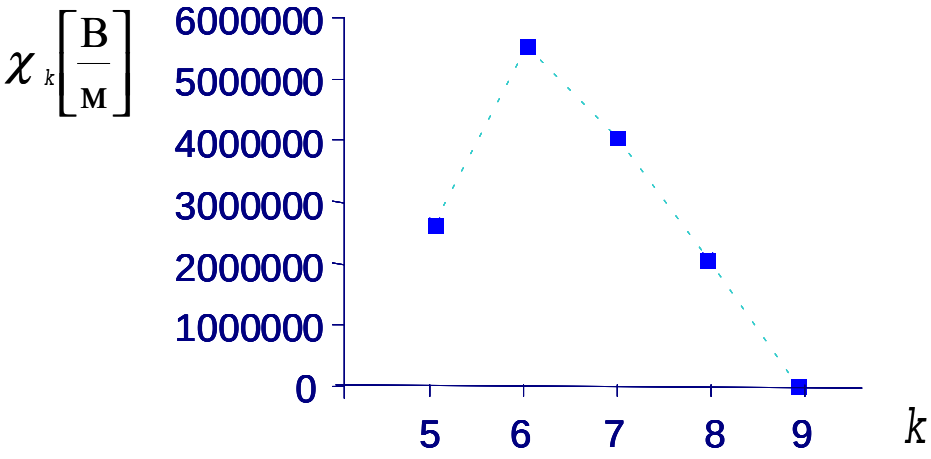

Fig.4 Electric field χ_k on a surface of planets of external group

The results of calculations of field χ_k on the surfaces restricted by radiuses of R_k^* in atmosphere depths of Jupiter, Saturn, Uranus and Neptune, have shown the huge intensity electric fields, which considerably exceed electric fields that have been

calculated for surfaces of planets of terrestrial group. It is interesting to remark. Mars and Mercury as against Earth does not have appreciable ionosphere but powerful lightning is observed and at atmosphere of Jupiter and at atmosphere of Saturn. Electrostatic fields on surfaces of Mercury and Mars are comparable and they are small in comparison with the appropriate fields on surfaces of Venus and the Earth. Thunder - storms are observed at atmosphere of Venus, but at Venus as against Earth there are no and of appreciable magnetic field and of an ionosphere. Probably, absence of a magnetic field on Venus is caused by slow rotation of this planet around of its axis with the period $T_{\otimes,2}$, which is even greater than its period of rotation around of the Sun T_2:

$$T_{\otimes,2} = 2.094 \cdot 10^7 \text{ sec} > T_2 = 1.936 \cdot 10^7 \text{ sec}.$$

At calculations of electrostatic fields χ_k own rotation of planets around of their own axes of rotation was not taken into account, but probably really rotating planets with the big intensity of a radial electric field should have both significant ionospheres and magnetic fields.

Thus, results of calculation of prospective electrostatic fields χ_k on surfaces of planets as a whole do not contradict astronomical observations, and it is possible to count confirmed the applicability of expressions (15), (16) for calculation of an electrostatic field on a surface of the Earth.

3. CONCLUSION

The carried out analysis has shown that there is distinction of Newtonian gravitational constant at vicinities of Jupiter, Saturn, Uranus and Neptune and this phenomenon may be important for navigation of space vehicles. The further researches in this field should be continued by a method of direct measurements of a gravitational constant with the help of accelerometers installed on space vehicles.

The empirical law for an estimation of an electrostatic field on surfaces of the planets that is corresponding to results of measurement of an electrostatic field on a surface of the Earth is offered. In accordance with this Law, probably depths of all planets outside of the crust and the mantle are filled with a substance, which is possessing at average by coefficient of permeability 1 for the electrostatic field.

Within the framework of the considered model of excitation of an electrostatic field in depths of the Earth, the hypothesis about fulfillment of the law of equal distribution of gravitational and electric components of energies that are responsible for processes of excitation of electrostatic and of gravitational fields of the Sun and planets in the regions restricted by their gravitational radiuses, is put forward.

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P.S.

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