ON THE NATURE OF GRAVITATION OF BODIES

© G. L. Abramyan

The Nizhny Novgorod State Technical University
Nizhny Novgorod, Russia
E – mail: esvm@nntu.nnov.ru
Home/ 603006 Gorky Str., H 149A, Apt 18, Nizhny Novgorod, Russia
Tel. +7 8312 192593; e– mail: agl-esvm@yandex.ru

The expression which defines ratio of masses of planets and mass of the Sun of the classical mechanics through directly measurable parameters - the sizes of the Sun and planets, sidereal period of rotation of the Sun, the velocity of light and acceleration of free falling of bodies near to a surface of planets is received. The analysis developed in this article show that distribution of an average velocities of remote satellites of Jupiter and Saturn are defined by means of the special law that is taking place for their adjacent orbits.

1. INTRODUCTION

The analysis executed in [1-3] has shown that the size and period of rotation of planets around of the Sun, the spatial distribution of planets and of their satellites in Solar system depend on the period of Sun rotation around axis and the size of the Sun and gravitation on a surface of planets in Solar system depends on the period of their rotation along orbits. The geometrical axiomatics, based on Third Kepler Law has been introduced in [2]. The executed analysis has shown that in this axiomatics the spatial distribution of major planets and their satellites has S - figurative distribution independently of their mass and the sizes. The law for an estimation of an electrostatic field on surface of the planets that is offered in [3] describes electrostatic field of planets in accordance with result of its measurement on a surface of the Earth. In accordance to this empirical law in [3] the hypothesis is put forward, that probably in depths of all planets, outside of its crust and mantle, planets are filled with a substance with coefficient of permeability for an electrostatic field at an average of order 1. The analysis executed in [1-3] testifies for the benefit of a hypothesis of existence of vortical hierarchical structure of Solar system. The analysis testifies that area outside of bodies, nevertheless, is material, is filled with radiation, and its material properties are found out in ability of propagation of energy of radiation between separate bodies with constant group velocity. It is similar to propagation of sound energy in the homogeneous material environment between atoms on distances considerably exceeding their sizes. The basic properties of bodies - properties of rotation: there, where there are bodies there are always observed of their rotation relatively each other. The substance and radiation are interacting and they permanently exchange a part of their energy. Therefore it is naturally to ask the question whether material bodies are a kind of vortical formations of some continuous intangible by us substance, and the essence of a nature of gravitation of bodies consists in a mutual interacting of their vortical field of radiations that are embracing any body. The answer to this question can be clearing an opportunity to express mass gravitational coefficients of the classical mechanics

through parameters that are directly measurable, such as the geometrical sizes of bodies and velocity of their rotation in an environmental field of radiation embracing them.

The acceleration of free falling of bodies on a seen surface of the Sun [1,2] is determined by means of formula

$$g_{\otimes} = \gamma \frac{M_{\otimes}}{R_{\otimes e}^2} = 2.737 \cdot 10^4 \frac{\text{cm}}{\text{sec}^2}.$$

And "gravitation" on a surface of the Sun in its equatorial ring formation equals

$$g_{\otimes e} = g(B) = \frac{2C}{T_{\otimes e}} = 2.7417 \cdot 10^4 \frac{\text{cm}}{\text{sec}^2}, \quad -16^{\circ} \le B \le +16^{\circ}.$$

Both parameters coincide with a relative error of 0, 2 %:

$$g_{\otimes} = g_{\otimes e} = \frac{2C}{T_{\otimes e}} \ . \tag{1}$$

Here $R_{\otimes e} = 6.96 \cdot 10^{10}$ cm is the radius of the Sun, $T_{\otimes e} = 21{,}868449 \cdot 10^5$ sec is sidereal period of rotation of the Sun is corresponding to heliographic latitude B in equatorial ring formation on a seen surface of the Sun in a range $-16^{\circ} \le B \le +16^{\circ}$, $\gamma = \frac{1}{15} \cdot 10^{-6} \frac{\text{cm}^3}{\text{g}\,\text{sec}^2}$ is the gravitational constant of the classical mechanics, $C = 2.9979246 \cdot 10^{10}\ \text{cm}/\text{sec}^2$ is the group velocity of radiation, $M_{\otimes} = 1.989 \cdot 10^{33}$ g is the mass of the Sun.

Taking into account (1), we supposed that essence of all bodies' substance represent whirlwinds of some continuous field of radiation which are embracing the environment of all bodies and naturally the Sun too, that pull external bodies to its surface owing to vortical circulation around of ones. It is naturally to suppose that velocity of this vortical flux that is embracing Sun is equal to velocity of its visible surface:

$$V_{\otimes e} = \frac{2\pi R_{\otimes e}}{T_{\otimes e}} = \frac{2\pi R_{\otimes e}}{2C} g_{\otimes e}. \tag{2}$$

By taking into consideration the similarity of nature of gravitation of planets and the Sun, it is possible to define velocities V_k of flux of whirlwinds of a field of the radiation which are flowing round surfaces of k - th planets by analogy to expression (2) as:

$$V_k = \frac{2\pi R_k}{T_k^*} = \frac{2\pi R_k}{2C} g_k. \tag{3}$$

Here T_k^* is the prospective period of circulation of a field of radiation that is flowing round a planet:

$$T_k^* \equiv \frac{2C}{g_k}, \tag{4}$$

Here g_k is the acceleration of free falling on a surface of k - th planets.

We suppose that energy E of attraction by means of gravity of any body with mass $m \sim E$ is proportional to velocity of a vortical flux of a field of radiation that is embracing body and this energy is proportional to the size of a body too, so we have, in particular:

for mass of the Sun an expression $M_{\otimes} \sim R_{\otimes e}\, V_{\otimes e}$, (5)

and for mass m_k of k - th planets $m_k \sim R_{\rm k}\, V_{\rm k}$. (6)

By means of using expressions (1), (2), (3), (4), (5) and (6) it is possible to show, that the gravitational masses of k - th of planets is defined by expression:

$$m_k = M_{\otimes} \frac{R_k^2\, T_{\otimes e}}{R_{\otimes e}^2\, T_k^*}, \quad k = 1,2,...,9,.... \tag{7}$$

The analysis of the empirical data has shown that the expression (7) really defines mass coefficients m_k for planets of Solar system in units of mass of the Sun $M_{\otimes}$.

2. THE ANALYSIS OF DATA.

2.1 Mass coefficients m_k of planets of Solar system.

For the comparison of results of calculations of masses m_k of planets of Solar system according to expression (7) with results of definition of masses of planets m_k^C within the classical mechanics we are using data [4,5]. The calculation of masses of planets with the help (7) is showing that all of results of calculation are practically identical to data that are in common use in modern astronomy.

<u>for planet Mercury</u>:
The average radius is $R_1 = 2.44 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_1 = 370{,}1$ cm/sec^2,
The period of circulation of the field of radiation that is flowing around of Mercury $T_1^* = 1.6204 \cdot 10^8$ sec,
The mass of Mercury that is determined by means of the classical mechanics $m_1^C = 0.3302 \cdot 10^{27}$ g,
The mass of Mercury that is calculated with the help of expression (7) $m_1 = 0.3299 \cdot 10^{27}$ g.

<u>for planet Venus</u>:
The average radius is $R_2 = 6.05184 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_2 = 887$ cm/sec^2,
The period of circulation of the field of radiation that is flowing around of Venus $T_2^* = 6.7596 \cdot 10^7$ sec,
The mass of Venus that is determined by means of the classical mechanics $m_2^C = 4.8685 \cdot 10^{27}$ g,
The mass of Venus that is calculated with the help of expression (7) $m_2 = 4.8651 \cdot 10^{27}$ g.

for planet Earth:
The average radius is $R_3 = 6.37101 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_3 = 978.0327 \, \text{cm}/\text{sec}^2$,
The period of circulation of the field of radiation that is flowing around of Earth
$T_3^* = 6.1305 \cdot 10^7$ sec,
The mass of Earth that is determined by means of the classical mechanics
$m_3^C = 5.9736 \cdot 10^{27}$ g,
The mass of Earth that is calculated with the help of expression (7)
$m_3 = 5.9458 \cdot 10^{27}$ g.

for planet Mars:
The average radius is $R_4 = 3.38992 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_4 = 369 \, \text{cm}/\text{sec}^2$,
The period of circulation of the field of radiation that is flowing around of Mars
$T_4^* = 1.6248 \cdot 10^8$ sec,
The mass of Mars that is determined by means of the classical mechanics
$m_4^C = 0.64185 \cdot 10^{27}$ g,
The mass of Mars that is calculated with the help of expression (7)
$m_4 = 0.6351 \cdot 10^{27}$ g.

for planet Jupiter:
The average radius $R_5 = 69.911 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_5 = 2312 \, \text{cm}/\text{sec}^2$,
The period of circulation of the field of radiation that is flowing around of Jupiter
$T_5^* = 2.5933 \cdot 10^7$ sec,
The mass of Jupiter that is determined by means of the classical mechanics
$m_5^C = 1898.6 \cdot 10^{27}$ g,
The mass of Jupiter that is calculated with the help of expression (7)
$m_5 = 1692.2811 \cdot 10^{27}$ g.

for planet Saturn:
The average radius $R_6 = 58.232 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_6 = 896 \, \text{cm}/\text{sec}^2$,
The period of circulation of the field of radiation that is flowing around of Saturn
$T_6^* = 6.6917 \cdot 10^7$ sec,
The mass of Saturn that is determined by means of the classical mechanics
$m_6^C = 568.46 \cdot 10^{27}$ g,
The mass of Saturn that is calculated with the help of expression (7)
$m_6 = 525.95 \cdot 10^{27}$ g.

for planet Uranus:
The average radius $R_7 = 25.362 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_7 = 869 \,\mathrm{cm/sec^2}$,
The period of circulation of the field of radiation that is flowing around of Uranus $T_7^* = 6.8997 \cdot 10^7$ sec,
The mass of Uranus that is determined by means of the classical mechanics $m_7^C = 86.832 \cdot 10^{27}$ g,
The mass of Uranus that is calculated with the help of expression (7) $m_7 = 83.709 \cdot 10^{27}$ g.

for planet Neptune:
The average radius $R_8 = 24.624 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_8 = 1100 \,\mathrm{cm/sec^2}$,
The period of circulation of the field of radiation that is flowing around of Neptune $T_8^* = 5.4507 \cdot 10^7$ sec,
The mass of Neptune that is determined by means of the classical mechanics $m_8^C = 102.43 \cdot 10^{27}$ g,
The mass of Neptune that is calculated with the help of expression (7) $m_8 = 99.88 \cdot 10^{27}$ g.

for planet Pluto (by the decision of the International Astronomical Union the Pluto which has rather small size in comparison with other major planets of Solar system, in our opinion without enough arguments, is referred to objects of belt of Kuiper):
The average radius $R_9 = 1.151 \cdot 10^8$ cm,
The acceleration of free falling on a surface is $g_9 = 65.5 \,\mathrm{cm/sec^2}$,
The period of circulation of a field of radiation flowing round Pluto $T_9^* = 9.1539 \cdot 10^8$ sec,
The mass of Pluto that is determined by means of the classical mechanics $m_9^C = 0.015 \cdot 10^{27}$ g,
The mass of Pluto that is calculated with the help of expression (7) $m_9 = 0.013 \cdot 10^{27}$ g.

Thus, the results of calculations of gravitational masses coefficients for the major planets that are defined in classical mechanics, with the help of expression (7), in accordance to the interpretation of gravitation of planets by means of hypothesis about of existence of some phenomenon of sucking in by planets of the whirlwinds of some field substance, which circulates around of all bodies, planets and the Sun, only a little bit differ from those magnitudes that were determined within the axiomatics of the mechanics of Newton and it clearly shows the summary table of results of calculations of masses of planets:

planets	*Mercury*	*Venus*	*Earth*	*Mars*	
m_i^C g	$0{,}3302 \cdot 10^{27}$	$4{,}8685 \cdot 10^{27}$	$5.9736 \cdot 10^{27}$	$0.64185 \cdot 10^{27}$	
m_i g	$0{,}3299 \cdot 10^{27}$	$4{,}8651 \cdot 10^{27}$	$5.9458 \cdot 10^{27}$	$0.6351 \cdot 10^{27}$	
planets	*Jupiter*	*Saturn*	*Uranus*	*Neptune*	*Pluto*
m_i^C g	$1898.6 \cdot 10^{27}$	$568.46 \cdot 10^{27}$	$86.832 \cdot 10^{27}$	$102.43 \cdot 10^{27}$	$0.015 \cdot 10^{27}$
m_i g	$1692.28 \cdot 10^{27}$	$525.95 \cdot 10^{27}$	$83.709 \cdot 10^{27}$	$99.88 \cdot 10^{27}$	$0.013 \cdot 10^{27}$

2.2 The Law of squares of average orbital speeds of planets and their satellites.

We mark; orbital movement of planets and their natural satellites differs by relative stability as against orbital movement of artificial satellites of planets as it is known that height of flight of artificial satellites steadily goes down even in conditions of flight outside of atmosphere. In this connection an assumption arose about probability of existence except of circulation of a field of radiation around of planets, existence of an orbital circulation of a field of radiation along orbits of planets and existence of an orbital circulation of a field of radiation along orbits of natural satellites of planets. The field of radiation that is creating effect of gravitation directly intangible, but probably this field substance creates around of major planets the rings formations that give birth to satellites of planets. The rings formations are spatially stratified and probably it is the cause of special spatial distribution of satellites of planets which as well as planets submit to the Titius - Bode Law of planetary distances scale. We mark here that physical nature of the Titius - Bode Law has no interpretation within axiomatics of the classical mechanics. [1-3] By taking into account this circumstance and proceeding from the assumption that space between bodies not emptiness, but a kind of continuous substances, which intangible by us possibly owing to rather large scale of their movement in comparison with the particles of microcosm (that represent , probably, the vortical formations of more small scale), the investigation of a ratio between squares of average speeds of orbital movement of planets and their satellites at the neighboring orbits, was undertaken.

The spatial distribution of orbits of planets and their satellites being described by means of *S* - distributions, is investigated in [1-3]. The recent experimental astronomical researches have expanded number of satellites of planets known in 2003; therefore we'll represent here the modern data about *S*-distribution. This distribution represent function of r - parameter in dependence on number of orbits of a bodies in ascending order of their average distance a from the central body with the greatest gravitational radius R_g that are moving along elliptic orbits with an average speed V according to Law of Kepler which, as shown in [2], it is possible to present in Utting's form by the formula:

$$r = \frac{1}{\theta} = \frac{C}{V} = \sqrt{\frac{a}{R_g}}, \quad \varepsilon = \sqrt{1 - \frac{b^2}{a^2}} << 1. \tag{8}$$

Here ε is eccentricity, a is semi-major axis and b is small semi axis of an elliptic orbit of a planet (or of the satellite of a planet), which is moving along Kepler's or-

bit. The parameter θ defines "visible" angular distance between focuses of an elliptic trajectory of a body that is making orbital movement from a direction of perpendicular to its major axis, from a point of an orbit located on distance of focal parameter b^2/a from a line of apses of the ellipse. [2]

In figure 1 the $r_{5,i}$ - parameter dependence on i - th number of Jupiter's satellites in ascending order of their distances up to Jupiter is presented.

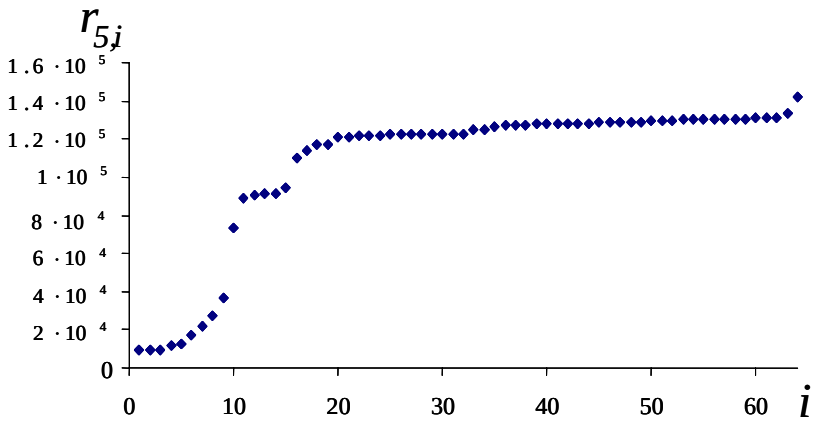

Fig. 1 S - distribution of satellites of the Jupiter.

Here $r_{5,i} = \frac{1}{\theta_{5,i}} = \frac{C}{V_{5,i}} = \sqrt{\frac{a_{5,i}}{R_{5,g}}}$ are r parameters of the Jupiter's satellites,

$\theta_{5,i}$ is the "visible" angular distance between focuses of an ellipse,

$V_{5,i}$ is the average orbital speed of i -th satellite.

$a_{5,i}$ is the average distance of i - th satellite,

$R_{5,g} = 140.9\,\text{cm}$ is the gravitational radius of the Jupiter.

In figure 2 the $z_{5,i}$ - parameter dependence on i - th number of Jupiter's satellites in ascending order of their distances up to Jupiter is presented.

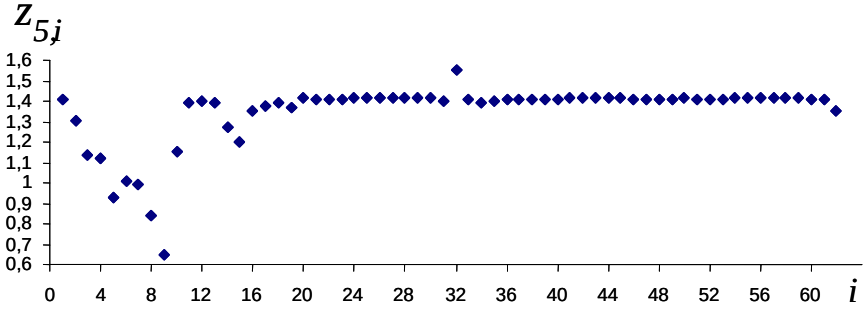

Fig. 2 The Law of average orbital speeds of satellites of the Jupiter.

Here

$$z_{5,i} = \frac{\sqrt{\theta_{5,i+1}^2 + \theta_{5,i+2}^2}}{\theta_{5,i}};$$

$$z_{5,i}^2 V_{5,i}^2 = V_{5,i+1}^2 + V_{5,i+2}^2 \Leftrightarrow z_{5,i}^2 \theta_{5,i}^2 = \theta_{5,i+1}^2 + \theta_{5,i+2}^2 \Leftrightarrow \frac{z_{5,i}^2}{a_{5,i}} = \frac{1}{a_{5,i+1}} + \frac{1}{a_{5,i+2}} \quad .$$

In figure 3 the $r_{6,i}$ - parameter dependence on i - th number of Saturn's satellites in ascending order of their distances up to Jupiter is presented.

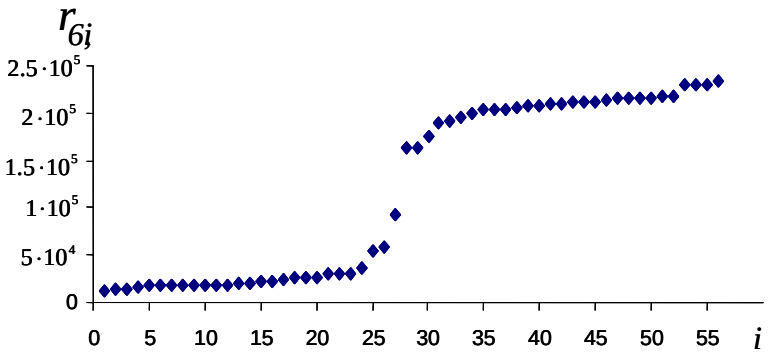

Fig. 3 S - distribution of satellites of the Saturn.

Here $r_{6,i} = \frac{1}{u_{6,i}} = \frac{C}{V_{6,i}} = \sqrt{\frac{a_{6,i}}{R_{6,g}}}$ are r parameters of the Saturn's satellites,

$\theta_{6,i}$ is the "visible" angular distance between focuses of an ellipse,

$V_{6,i}$ is the average orbital speed of i -th satellite.

$a_{6,i}$ is the average distance of i - th satellite,

$R_{6,g} = 42.13$ cm is the gravitational radius of the Saturn.

In figure 4 the $z_{6,i}$ - parameter dependence on i - th number of Saturn's satellites in ascending order of their distances up to Saturn is presented.

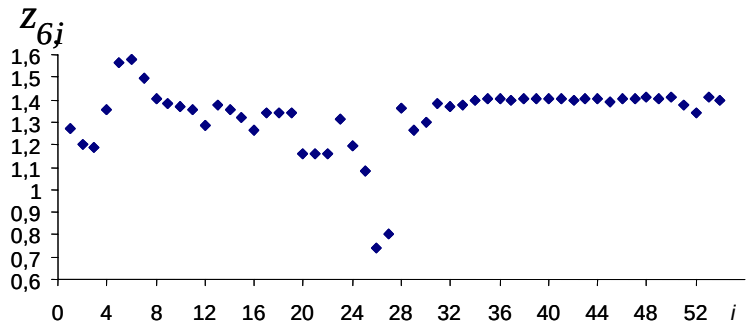

Fig. 4 The Law of average orbital speeds of satellites of the Saturn.

Here

$$z_{6,i} = \frac{\sqrt{\theta_{6,i+1}^2 + \theta_{6,i+2}^2}}{\theta_{6,i}};$$

$$z_{6,i}^2 V_{6,i}^2 = V_{6,i+1}^2 + V_{6,i+2}^2 \Leftrightarrow z_{6,i}^2 \theta_{6,i}^2 = \theta_{6,i+1}^2 + \theta_{6,i+2}^2 \Leftrightarrow \frac{z_{6,i}^2}{a_{6,i}} = \frac{1}{a_{6,i+1}} + \frac{1}{a_{6,i+2}}.$$

In figure 5 the $r_{7,i}$ - parameter dependence on i - th number of Uranus's satellites in ascending order of their distances up to Saturn is presented.

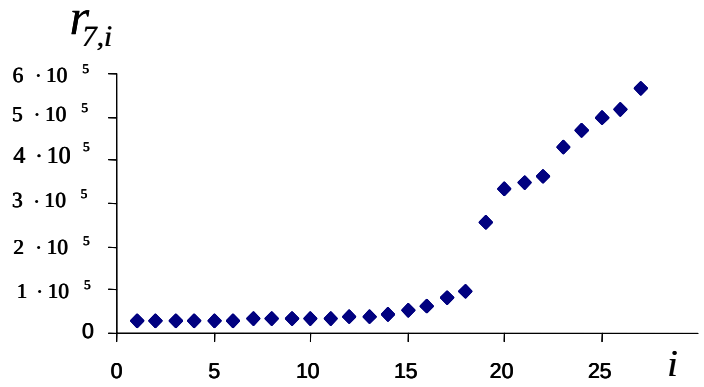

Fig. 5 S - distribution of satellites of the Uranus.

Here $r_{7,i} = \frac{1}{u_{7,i}} = \frac{C}{V_{7,i}} = \sqrt{\frac{a_{7,i}}{R_{7,g}}}$ are r parameters of the Uranus' satellites.

$\theta_{7,i}$ is the "visible" angular distance between focuses of an ellipse,

$V_{7,i}$ is the average orbital speed of i -th satellite.

$a_{7,i}$ is the average distance of i - th satellite,

$R_{7,g} = 6.53\,\text{cm}$ is the gravitational radius of the Uranus.

In figure 6 the $z_{7,i}$ - parameter dependence on i - th number of Uranus's satellites in ascending order of their distances up to Uranus is presented.

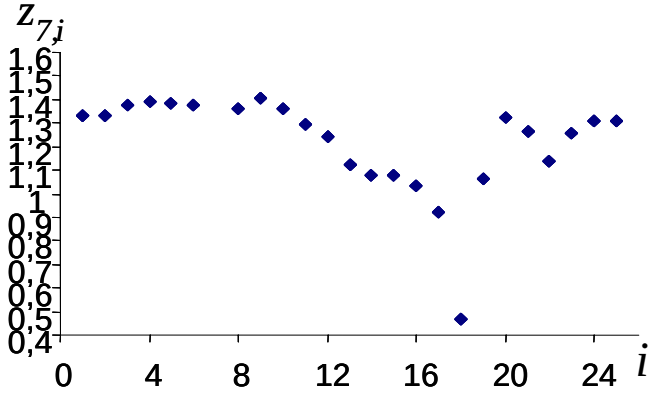

Fig. 6 The Law of average orbital speeds of satellites of the Uranus.

Here

$$z_{7,i} = \frac{\sqrt{\theta_{7,i+1}^2 + \theta_{7,i+2}^2}}{\theta_{7,i}} \ ;$$

$$z_{7,i}^2 V_{7,i}^2 = V_{7,i+1}^2 + V_{7,i+2}^2 \Leftrightarrow z_{7,i}^2 \theta_{7,i}^2 = \theta_{7,i+1}^2 + \theta_{7,i+2}^2 \Leftrightarrow \frac{z_{7,i}^2}{a_{7,i}} = \frac{1}{a_{7,i+1}} + \frac{1}{a_{7,i+2}} \ .$$

In figure 7 the $r_{8,i}$ - parameter dependence on i - th number of Neptune's satellites in ascending order of their distances up to Neptune is presented.

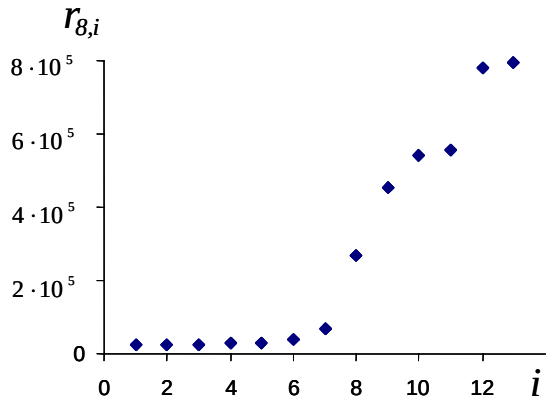

Fig. 7 S - distribution of satellites of the Neptune.

Here $r_{8,i} = \frac{1}{\theta_{8,i}} = \frac{C}{V_{8,i}} = \sqrt{\frac{a_{8,i}}{R_{8,g}}}$ are r parameters of the Neptune's satellites.

$\theta_{8,i}$ is the "visible" angular distance between focuses of an ellipse,

$V_{8,i}$ is the average orbital speed of i -th satellite.

$a_{8,i}$ is the average distance of i - th satellite,

$R_{8,g} = 7.64\,\text{cm}$ is the gravitational radius of the Neptune .

In figure 8 the $z_{8,i}$ - parameter dependence on i - th number of Neptune's satellites in ascending order of their distances up to Neptune is presented.

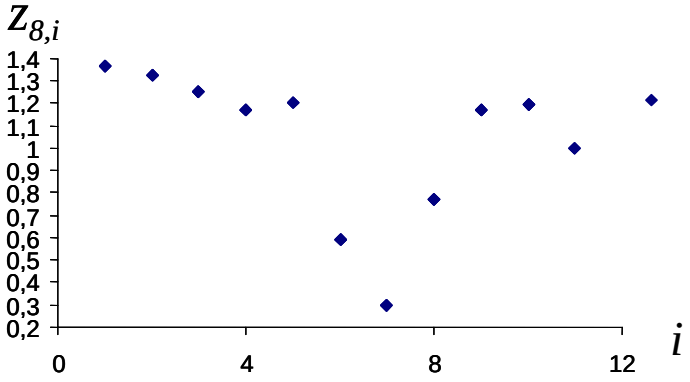

Fig.8 The Law of average orbital speeds of satellites of the Neptune.

Here

$$z_{8,i} = \frac{\sqrt{\theta_{8,i+1}^2 + \theta_{8,i+2}^2}}{\theta_{8,i}} \ ;$$

$$z_{8,i}^2 V_{8,i}^2 = V_{8,i+1}^2 + V_{8,i+2}^2 \Leftrightarrow z_{8,i}^2 \theta_{8,i}^2 = \theta_{8,i+1}^2 + \theta_{8,i+2}^2 \Leftrightarrow \frac{z_{8,i}^2}{a_{8,i}} = \frac{1}{a_{8,i+1}} + \frac{1}{a_{8,i+2}} \ .$$

In figure 9 the r_k - parameter dependence on k - th number of planets in ascending order of their distances up to the Sun is presented.

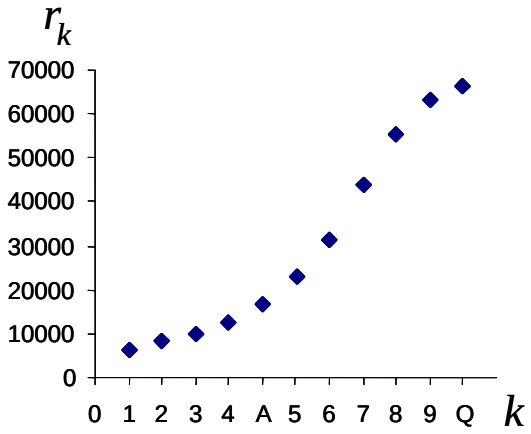

Fig.9 *S* - distribution of planets.

Here $r_k = \frac{1}{\theta_k} = \frac{C}{V_k} = \sqrt{\frac{a_k}{R_{\otimes,g}}}$ is r - parameter of planets:

θ_k is the "visible" angular distance between focuses of an ellipse,

V_k is the average orbital speed of k -th planet.

a_k is the average distance of k - th planet,

$R_{\otimes,g} = 1.4777 \cdot 10^5 \, cm$ is the gravitational radius of the Sun,

To symbol A on an axis k there corresponds an average value of r - parameter r_A for more than 50 000 objects in the first belt of asteroids, the symbol Q marks position of Quaoar – an object of belt of Kuiper.

In figure 10 z_k - parameter dependence on k - th number of planets in ascending order of their distances up to the Sun is presented.

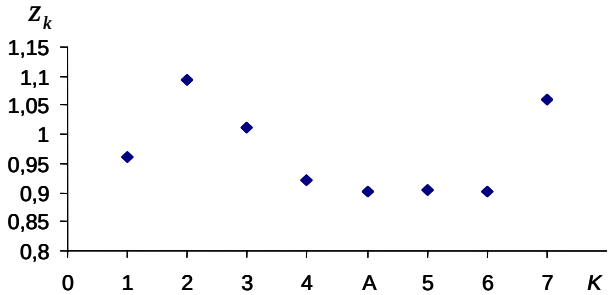

Fig.10 The Law of average orbital speeds of planets.

Here

$$z_s = \frac{\sqrt{\theta_{s+1}^2 + \theta_{s+2}^2}}{\theta_s};$$

$$z_s^2 V_s^2 = V_{s+1}^2 + V_{s+2}^2 \Leftrightarrow z_s^2 \theta_s^2 = \theta_{s+1}^2 + \theta_{s+2}^2 \Leftrightarrow \frac{z_s^2}{a_s} = \frac{1}{a_{s+1}} + \frac{1}{a_{s+2}} \quad ;$$

$$k = s = 1,2,3,4; \quad k = s-1 = 5,6,7,8,9; \quad s = 5 \to k \equiv A \quad - belt\, of\, asteroids.$$

Comparing dependences of change $r_{k,i}$ and $z_{k,i}$ parameters for satellites of planets with parameters r_k and z_k for planets, we shall mark, that all r - parameters have similar *S* - shaped distributions, however for enough removed satellites of the Jupiter and Saturn z - parameters have approximately identical value

$$z_{k,i} \cong 1,4 \quad \text{for} \quad k = 5;\ 20 \le i \le 60; \quad k = 6;\ 30 \le i \le 50; \tag{9}$$

$$2V_{k,i}^2 = V_{k,i+1}^2 + V_{k,i+2}^2 \Leftrightarrow 2\theta_{k,i}^2 = \theta_{k,i+1}^2 + \theta_{k,i+2}^2 \Leftrightarrow \frac{2}{a_{k,i}} = \frac{1}{a_{k,i+1}} + \frac{1}{a_{k,i+2}} \tag{10}$$

The ratio (10) is probable fairly for enough big number i and for satellites of Uranus and the Neptune. At small values of numbers i, parameter $z_{k,i}$ "are oscillating" as well as parameter z_k for planets, but with that difference that fluctuations of values z - parameters for planets occur in a vicinity of $z_k \sim 1$:

$$V_s^2 \sim V_{s+1}^2 + V_{s+2}^2 \Leftrightarrow \theta_s^2 \sim \theta_{s+1}^2 + \theta_{s+2}^2 \Leftrightarrow \frac{1}{a_s} \sim \frac{1}{a_{s+1}} + \frac{1}{a_{s+2}}; \qquad z_k \sim 1. \tag{11}$$

The differences in behavior of z - parameters for planets and satellites of planets, probably, are connected to features of research of spatial distribution of planets and satellites of planets: observation of planets is carrying out in “radial” direction, and observation of satellites of planets are executing somewhat from the side, as “a picture's observation” of their distribution in cosmos. Is this difference the one more evidence of materiality of a substance of a field of radiation between bodies and thus probably the whirlwinds of this field's substance are creating all that we name bodies in microcosm and macrocosm? To receive the reliable answer to this question, we need in more careful researches of propagation of radiation in Solar system; in particular we need in measurements of the velocity of propagation of signals of radiation in cosmos from the space vehicles.

Probably, gravitational interaction and inertia of macro and micro bodies are explained by the interaction of theirs rotating structures and of a field of continuous substance that is flowing around of them. It is possible that "geometry curvature " and the cause of change of a direction of propagation of radiation nearby of massive bodies (effect of a lens) is explained by the spatial distribution of density of field continuous substances, the curls turbulence of which creates all that, we name bodies.

There is the well known paradox. The essence of this paradox consists in contradiction between the presence of a gravitational attraction between bodies and probable radial expansion of the Earth approximately on $2\,\mathrm{cm/year}$ (according to numerous measurements with the help of *VLBI* systems) and by the effect of expansion of the Metagalaxy as a whole, which reliably experimentally has been confirmed, at least, in cosmos adjoining to our Solar system. We suppose these paradoxes are explained by the high pressure of a field substance that creates turbulence of a field substance in the form of curls and of whirlwinds of various magnitudes, which are interacting with each other in Metagalaxy.

Results of the research executed in the given work, confirm the conclusions of the analysis executed in [1-3] that spatial distribution of planets and their satellites represents hierarchical ensemble of cooperating bodies which properties depend on the period of rotation of the Sun.

In recent research the special axial direction in distribution of space radiation in the Metagalaxy is found. [6]. We suppose that this investigation testifies to existence of strictly hierarchical structure of all Universe, which is provided by means of interaction of streams of a field of some continuous substance in cosmos. The field substance probably is rotated with various velocities and this field substance is embracing of all the bodies of the Universe. This condensate probably presents micro and macro bodies. Thus, we suppose that our analysis of Solar system gives us grounds to suppose that all bodies on nature are interacting as vortical formations of a field of radiation of various scales. Probably, the vortical movement of some field substance that is embracing space bodies on scales of congeries of galaxies corresponds to the phenomenon, which has received in modern astronomy the name “Dark Matter”; and relatively sluggish and large-scale movement of a field of vacuum in the Metagalaxy as a whole, on the bigger distances, probably defines a nature of influence of “Dark Energy”.

3. CONCLUSION

The interpretation of gravitational mass coefficients of the classical mechanics by means of use of a hypothesis according to which the essence of bodies are represented by the whirlwinds of some field substance of radiation are developed; the empirical law that defines the relation of mass coefficients of any planet and the Sun of the classical mechanics through directly measurable parameters - the sizes of the Sun and planet, sidereal period of rotation of the Sun, the group velocity of radiation and the acceleration of free falling of bodies nearby of a surface of planets is received.

The analysis has shown, that for any sequence of three distant satellites of planets Jupiter and Saturn, which are flying on adjacent orbits, the average speeds of their orbital movement are connected by a ratio according to which the double square of the speed of the first satellite approximately equal to the sum of squares of speeds of two subsequent satellites, which have orbits further from a planet.

The similar ratio is taking place and for planets with that difference, that the square of speed of the first planet approximately equals the sum of squares of speed of two subsequent more remote planets; the Belt of asteroids is included to the row of planets with the help of some virtual object that has average orbit and speed which are average orbit and speed approximately 50 000 asteroids of the Belt.
The distinction of ratios found for squares of speeds of planets and satellites of planets, probably, are connected to features of research of spatial distribution of planets and satellites of planets: the movements of planets are investigated along radius of observation at depth of cosmos, and satellites of planets are observing up to a certain extent as kind of “the whole picture”, which we are looking completely at some distance aloof.

SUPPLEMENT

The magnitudes of semi axes of orbits of satellites and rings of the Jupiter, Saturn, Uranus and the Neptune that are known by the beginning of 2007 are presented accordingly in the tables 1, 2, 3 and 4. Numbers i are counting of in ascending order of distances up to satellites and up to rings of k-th planet.

TABLE 1

i	*satellites*	$a_{5,i} \cdot 10^{-10}$ cm	i	*satellites*	$a_{5,i} \cdot 10^{-10}$ cm
1	Metis	1.281	33	S 2003 J15	220.0
2	Adrastea	1.289	34	S 2003 J17	220.0
3	Ring Gossamer	1.292	35	S 2003 J9	224.4168
4	Amalthea	1.814	36	S 2003 J19	228.0
5	Thebe	2.219	37	Eurydome	228.65
6	Io	4.218	38	Arche	229.31
7	Europa	6.711	39	Autonae	230.39
8	Ganymede	10.704	40	Pasithee	230.96
9	Callisto	18.827	41	Chaldene	231.79
10	Themisto	75.07	42	Kale	232.17
11	Leda	111.65	43	Isonoe	232.17
12	Himalia	114.61	44	Aitne	232.31
13	Lysithea	117.17	45	S2003 J4	232.5792
14	Elara	117.41	46	Erinome	232.79
15	S 2000 J1	125.55	47	Taygete	233.6
16	Carpo	169.89	48	Carme	234.04
17	S 2003 J3	183.40	49	Sponde	234.87
18	Euporie	193.02	50	Kalyke	235.83
19	S 2003 J12	193.05	51	Pasiphae	236.24
20	S 2003 J18	207.0	52	Eukelade	236.61
21	Orthosie	207.21	53	Megaclite	238.06
22	Euante	207.99	54	Sinope	239.39
23	Thyone	209.4	55	Hegemone	239.47
24	S 2003 J16	210.0	56	Aoede	239.81
25	Mneme	210.69	57	Kallichore	240.43
26	Harpalyke	211.05	58	S 2003 J23	240.555
27	Hermippe	211.31	59	S 2003 J5	240.8418
28	Praxidike	211.47	60	Callirrhoe	241.02
29	Thelxinoe	211.62	61	S 2003 J10	242.496
30	Helike	212.63	62	Cyllene	243.49
31	Iocaste	212.69	63	S 2003 J14	250.0
32	Ananke	212.76	64	S 2003 J2	285.7041

TABLE 2

i	*спутники*	$a_{6,i} \cdot 10^{-8}$ см	i	*спутники*	$a_{6,i} \cdot 10^{-8}$ см
1	Ring D	66	29	Ijiraq	11125.0
2	Ring C	74.5	30	Phoebe	12944.3
3	Ring B	90.0	31	Paaliaq	15200.0
4	Ring A	122.2	32	Skathi	15539.0
5	Pan	133.6	33	Albiorix	16182.0
6	Daphnis	136.5	34	S 2004 S11	16950.0
7	Atlas	137.7	35	Erriapo	17342.0
8	Prometheus	139.4	36	Siarnaq	17531.0
9	Ring F	140.21	37	S 2006 S8	17610.0
10	Pandora	141.7	38	Tarvos	17982.0
11	Epimetheus	151.4	39	S 2006 S4	18105.0
12	Janus	151.5	40	S 2004 S19	18217.125
13	Ring E	180.0 – 480.0	41	Mondilfari	18418.0
14	Mimas	185.6	42	S 2004 S13	18450.0
15	Methone	194.0	43	S 2004 S15	18750.0
16	Pallene	211.0	44	S 2006 S1	18981.135
17	Enceladus	238.1	45	Narvi	19007.0
18	Tethys	294.7	46	S 2004 S10	19350.0
19	Calypso	294.7	47	Suttungr	19459
20	Dione	377.4	48	S 2004 S18	19650
21	Helene	377.4	49	S 2004 S12	19650
22	Polydeuces	377.4	50	S 2004 S09	19800
24	Rhea	527.1	51	Thym	19941
25	Titan	1221.9	52	S 2004 S14	19 950
26	Hyperion	1464.1	53	S 2004 S08	22200
27	Iapetus	3560.8	54	S 2004 S16	22200
28	Kiviuq	11110.0	55	S 2006 S07	22290
			56	Ymir	23041

TABLE 3

i	*спутники*	$a_{7,i} \cdot 10^{-10}$ см	i	*спутники*	$a_{7,i} \cdot 10^{-10}$ см
1	Cordelia	0.498	15	Ariel	1.909
2	Ophelia	0.538	16	Umbriel	2.660
3	Bianca	0.592	17	Titania	4.363
4	Cressida	0.618	18	Oberon	5.835
5	Desdemona	0.627	19	Francisco	42.76
6	Juliet	0.644	20	Caliban	72.31
7	Portia	0.661	21	Stephano	80.04
8	Rosalind	0.699	22	Trinculo	85.04
9	Cupid	0.748	23	Sycorax	121.79
10	Belinda	0.753	24	Margaret	143.45
11	Perdita	0.7642	25	Prospero	125.56
12	Puck	0.860	26	Setebos	174.18
13	Mab	0.97734	27	Ferdinand	209.01
14	Miranda	1.299			

TABLE 4

i	*satellites*	$a_{8,i} \cdot 10^{-10}$cm	i	*satellites*	$a_{8,i} \cdot 10^{-10}$cm
1	Naiad	0.482	7	Triton	3.548
2	Thalassa	0.501	8	Nereid	55.134
3	Despina	0.525	9	S 2002 N1	157.28
4	Galatea	0.620	10	S 2002 N2	224.22
5	Larissa	0.735	11	S 2003 N3	235.71
6	Proteus	1.176	12	Psamathe	466.95
			13	S 2002 N4	483.87

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