

About Tsiganok Gravitation Theory (TGT)

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Abstract

Tsiganok gravitation law was discovered, Tsiganok gravitation theory was worked out. The definitions of body weight and body mass and density (specific gravity) were given. The definitions of gravitational constant were found and gravity acceleration constant of a body were found and defined. The weight, the mass, the gravity acceleration, the average density (specific gravity) and other parameters of the Earth, the Sun, the Moon etc. were defined. Body parameters in various points of the Universe were found. The Earth, the Sun, the Moon and other bodies were weighed in the state of weightlessness without scales. The centrifugal forces of the Earth, the Moon, and other bodies were found. The formula of the second law of motion was made more precise. The forces of gravitation between the Sun and the Earth and also between the Earth and the Moon were determined. The existence of the so-called Pioneer anomaly wasn't confirmed either theoretically or experimentally. The validity of centrifugal force formula, Tsiganok gravitation law as well as TGT were confirmed both theoretically and experimentally.

Keywords: Weight; Mass; Force; Centrifugal force; Gravitational constant; Gravitation law; Gravity acceleration; Distance; Speed; Density

Introduction

The development of science and technology radically changed the outlook of the mankind. The use of modern methods and devices in studying the Universe made it possible to find the answers to a number of questions concerning the structure and functions of the Solar System and the Universe on the whole.

The Earth gravity acceleration was found experimentally. Geometric dimensions of different bodies, the distance to them, the average orbital velocities as well as the photos and video images of various bodies were found with the help of optical telescopes. Their chemical composition and temperature were found (determined) with the help of spectral analysis. American astronauts delivered the samples of lunar soil to the Earth. Automatic space stations studied the surfaces of Venus and Mars, and those of Mercury, Jupiter, Saturn, etc. from the orbit.

However, a number of other actual questions have not been answered yet [1].

Numerous attempts to find the answers to these questions have not been successful. The reason of such a situation may be attributed to insufficient foundation of the existing gravitation theories [2].

Analysis of Publications

The notions of weight and mass became an integral part of our ideas about our environment long ago. These notions were used by everybody, they were discussed in numerous books, articles and dissertations, there being no complete clarity so far [3]. The doubtful: Newtonian gravity (NG) [4], General relativity (GR) [5], Quantum gravity (QG) [6], Canonical quantum gravity [7], Kaluza-Klein theory (KK theory) [8], String theory [9], Supergravity [10], Modified Newtonian Dynamics (MoND) [11], Scalar-tensor-vector gravity (STVG) [12], Tensor-vector-scalar gravity (TeVeS) [13], etc. were created on the basis of the known notions of weight and mass. In the result of such a pseudo-scientific activity no law of nature has been discovered in physics for the last 350 years. The mechanism of gravitation as well as that of electricity, light and other phenomena is still unknown. The mechanism of Pioneer anomaly [14] as well as of some other anomalies is also unknown.

While analyzing the results of the known researches one should mention the following main advantages of the work performed:

- the discovery of the law of free falling by G. Galilei in 1604 [15];
- the discovery of centrifugal force by Ch. Huygens in 1659 [16];
- the experimental determination of the Earth gravity acceleration;
- the determination of velocities of bodies velocities;
- the determination of the distances between various bodies;

The analysis of the known researches made it possible to formulate the following basic disadvantages of the work done:

- the known theories of gravitation are insufficiently grounded;
- the definitions and methods of determining the weight, mass, density (specific gravity) and other parameters of bodies are not grounded sufficiently;
- it is impossible to obtain dimensions of force from the product of masses and squared distance between them in the formula of Newton doubtful gravitational law;
- the equation in Newtonian gravitation theory $G \times \frac{M_1 \times M_2}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}}$ was "solved" by reducing the unknown mass in its left and right sides. Moreover, the elementary rules of mathematics were violated;
- Cavendish gravitational constant from the doubtful Newtonian gravitational law was found from a doubtful formula, but not as a result of the known experiment with a torsion balance [17].

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- the existence of the so-called gravitational mass and inertial mass was not explained [18];
- the absence of weight in the state of weightlessness wasn't proved;
- the results of experimental definition of centrifugal force don't coincide with theoretical or calculations;
- the validity of the second law of motion formula wasn't confirmed;
- the so-called Pioneer anomaly wasn't confirmed;
- the validity of Newton doubtful gravitation law and Newton doubtful gravitation theory with its mathematical apparatus weren't confirmed.

The Problem

In connection with the foregoing the research problems consist in:

- discovering Tsiganok gravitation law, elaborating Tsiganok gravitation theory (TGT), (known earlier as the new gravitation theory (the NGT)) [19] and its mathematical apparatus;
- giving the definition of body weight and body mass;
- defining weight and mass of the Earth, the Sun, the Moon etc.;
- finding gravity acceleration constant of gravity 1.0 g of the body;
- defining gravity acceleration of the Earth, the Sun, the Moon, etc.;
- finding gravitational constant;
- working out a temporary standard-copy of body weight and temporary standard-copy of body mass for Tsiganok measurement system;
- confirming or rejecting both experimentally and theoretically the validity of the measurement of density in $\frac{g}{cm^3}$;
- finding average density (specific gravity) of the Earth, of the Sun, of the Moon etc.;
- finding weight, mass, gravity acceleration, density (specific gravity) and other body parameters in various points of the Universe;
- proving or disproving both theoretically and experimentally that the Earth, the Sun, the Moon etc. have weight in the state of weightlessness;
- proving or disproving both theoretically and experimentally the existence of gravitational mass and inertial mass;
- finding centrifugal force of the Earth, the Moon etc;
- proving or disproving both theoretically and experimentally the validity of centrifugal force formula;
- finding the force of gravitational between the Sun and the Earth, between the Earth and the Moon;
- defining the formula of the second law of motion;
- proving or disproving both theoretically and experimentally the existence of the so-called Pioneer anomaly;
- creating the pre-requisites for defining weight, mass, gravity acceleration, density (specific gravity) and other parameters of atoms, atomic nuclei, electrons, protons, neutrons, the so-called elementary particles, etc.;
- proving or disproving both theoretically and experimentally

the validity of the doubtful Newtonian gravitational law formula, the doubtful Newtonian gravitation theory and its mathematical apparatus;

- proving or disproving theoretically and experimentally the validity of Tsiganokgravitation law formula, TGT and its mathematical apparatus.

Results

TGT and its mathematical apparatus were elaborated in order to solve the problems that were put forward. In the process of TGT elaboration it was found that the majority of notions and formulas in physics don't correspond to reality. That's why the main notions and formulas were worked out for the first time. Some known notions and formulas were made more precise.

TGT was based on Tsiganok gravitation formula (1) and its variants (2) and (3).

The force of gravitation-is the relation of the sum of the first body gravitation force to the second body $M_1 \times g_2$ and the second body to the first body $M_2 \times g_1$ to the squared distance between them R_{1-2}^2 that is obtained by Tsiganok gravitation law formulas (1), (2) and (3), expressed in $\frac{gcm}{s^2}$:

$$F_{1-2} = G \times \frac{M_1 \times g_2 + M_2 \times g_1}{R_{1-2}^2}, \quad (1)$$

or

$$F_{1-2} = \sqrt{G} \times \frac{\sqrt{G} \frac{M_1 \times g_2}{R_{1-2}} + \sqrt{G} \frac{M_2 \times g_1}{R_{1-2}}}{R_{1-2}}, \quad (2)$$

or

$$F_{1-2} = G \times \frac{M_1 \times g_2}{R_{1-2}^2} + G \times \frac{M_2 \times g_1}{R_{1-2}^2}, \quad (3)$$

Where F_{1-2} - is the gravitation force between the first and the second bodies, $\frac{gcm}{s^2}$;

G - is gravitational constant, cm^2 ;

M_1 - is the first body mass, g;

M_2 - is the second body mass, g;

g_1 - is the first body gravity acceleration, $\frac{cm}{s^2}$;

g_2 - is the second body gravity acceleration, $\frac{cm}{s^2}$;

R_{1-2} - is the distance between the first and the second bodies, cm.

Physical nature and the method of defining the force of gravitation between the first and the second bodies without using the so-called space time, gravitational lens, Higgsboson, etc. will be discussed later, in another work.

The references to define different parameters in other works are due to the fact that it is rather difficult to define the mechanism of the Universe functioning with practical calculations of each parameter on the examples of various bodies in accordance with TGT in one article. For this purpose not less than 4-6 articles may be necessary [20].

The force of gravitation between bodies, obtained with the help of the formulas of Tsiganok gravitation law (1), (2) and (3),

differs sufficiently from the force in the formula of Newton doubtful gravitation law:

- the formulas(1), (2) and (3) make it possible to define of the dimension force without taking into account gravitational constant;
- the masses of bodies being attracted aren't multiplied by each other but are multiplied by the corresponding gravity accelerations and are summed up only after this;
- gravitational constant has only those value dimensions that are included in the formulas(1), (2) and (3).

Centrifugal force of the second body is the force of repulsion of the second body (the Earth, the Moon, etc.) from the first body (the Sun, the Earth, etc.), equal to the force of gravitation between the first and the second bodies, equal to the relation of the product of the second body mass M_2 by the squared velocity of the second body V_2^2 to the distance from the first body to the second one R_{1-2} which is measured by the formula (4) expressed in gcm/s^2 .

The centrifugal force of the second body (the second body weight)- is the force of repulsion of the second body with mass M_2 , that is located on the surface of the first body with mass M_1 , from the first body with mass M_1 , equal to the centripetal force of the second body with mass M_2 to the first body mass M_1 , equal to the second body weight on the surface of the first body equal to the relation of the product of the second body mass M_2 (the mass of standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $M_{sta} = 1.0197 g$ etc.) placed on the surface of the first body with mass M_1 (the Earth, the Sun, the Moon, etc.) by squared velocity of the second body V_2^2 (squared first cosmic velocity of the Earth $V_{(ear-fcv)}^2 = (7.944 \times 10^5)^2 = 6.3107 \times 10^{11} cm^2/s^2$, squared first cosmic velocity of the Sun $V_{sun-fcv}^2 = (4.371 \times 10^7)^2 = 1.9106 \times 10^{15} cm^2/s^2$, squared first cosmic velocity of the Moon $V_{moo-fcv}^2 = (2.1197 \times 10^5)^2 = 4.493 \times 10^{10} cm^2/s^2$, etc.) to the distance from the first body to the second one R_{1-2} (the radius of the Earth $R_{ear} = 6.378 \times 10^8 cm$, the radius of the Sun $R_{sun} = 6.961 \times 10^{10} cm$, the radius of the Moon $R_{moo} = 1.7375 \times 10^8 cm$, etc.), equal to $F_{sta-ear} = 1000.0 gcm/s^2$ for the standard-copy weight of 1000.0 gcm/s^2 in TGT (1.0 kg in SI) on the surface of the Earth, equal to $F_{sta-sun} = 2.7988 \times 10^4 gcm/s^2$ for the standard-copy weight of 1000.0 gcm/s^2 in TGT (1.0 kg in SI) on the surface of the Sun, equal to $F_{sta-moo} = 263.684 gcm/s^2$ for the standard-copy weight of 1000.0 gcm/s^2 in TGT (1.0 kg in SI) on the surface of the Moon, etc., having action boundaries, aggregate state, volume, density (specific gravity), temperature, odour, taste, color and other properties, that can have various values and not having gravity acceleration, measured with the help of the formula (4), is measured with the help of dynamometer or scales expressed in gcm/s^2 .

The physical nature and the method of measuring the first cosmic velocity of the Earth, the Sun, the Moon etc. will be shown in another work.

The centrifugal force of the second body (the second body weight) F_{1-2} was found by the formula

$$F_{1-2} = \frac{M_2 \times V_2^2}{R_{1-2}}, \quad (4)$$

- where F_{1-2} - is centrifugal force of the second body, gcm/s^2 ;
- M_2 - is the second body mass, g;
- V_2 - is velocity of the second body, cm/s ;
- R_{1-2} - is the distance from the first body to the second one, cm .

It is reasonable to use the formula (4) to find the second body centrifugal force; the second body centripetal force; the second body weight on the surface of the first body having any radii; the weight of the second body immersed in a liquid or a gas on the surface of the first body having any radii.

The first body weight-is the product of the first body mass M_1 (mass standard-copy weight in 1000.0 gcm/s^2 TGT (1.0 kg in SI) $M_{sta} = 1.0197 g$, of the Earth mass, $M_{ear} = 3.824 \times 10^{24} g$ of the Sun mass, $M_{sun} = 1.273 \times 10^{30} g$ of the Moon mass, $M_{moo} = 7.483 \times 10^{22} g$ etc.) by the first body gravity acceleration g_1 (gravity acceleration of the standard-copy weight of 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $g_{sta} = 2.165 \times 10^{-22} cm/s^2$ the Earth gravity acceleration, $g_{ear} = 980.665 cm/s^2$ the Sun gravity acceleration, $g_{sun} = 3.625 \times 10^8 cm/s^2$ the Moon gravity acceleration $g_{moo} = 19.19 cm/s^2$ etc.), equal to standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI), $p_{sta} = 2.667 \times 10^{-22} gcm/s^2$ the Earth weight, $p_{ear} = 3.750 \times 10^{27} gcm/s^2$ the Sun weight $p_{sun} = 4.156 \times 10^{38} gcm/s^2$, the Moon weight $p_{moo} = 1.436 \times 10^{24} gcm/s^2$, etc. or the weight of any other body in the space, which is measured by the formula (5) or with the help of dynamometer or scales, expressed in gcm/s^2 .

The first body weight M_1 was found by the formula

$$P_1 = M_1 \times g_1, \quad (5)$$

- Where P_1 - is the first body weight, gcm/s^2 ;
- M_1 - is the first body mass, g;
- g_1 - is the first body gravity acceleration, cm/s^2 .

It is reasonable to use formula (5) for obtaining the weight of bodies in the space.

The second body weight-is the product of the second body mass M_2 (mass of the standard-copy weight $M_{sta} = 1.0197 g$ in TGT (1.0 kg in SI) $M_{sta} = 1.0197 g$, etc.), placed on the surface of the first body with mass M_1 (the Earth mass $M_{ear} = 3.824 \times 10^{24} g$, etc. having the same radius $R_{ear} = 6.378 \times 10^8 cm$ by the gravity acceleration of the first body g_1 (the Earth gravity acceleration $g_{ear} = 980.665 cm/s^2$, etc. of the same radius), equal to standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $P_{sta-ear} = 1000.0 gcm/s^2$ on the surface of the Earth etc., measured by the formula (6) with the help of a dynamometer or scales, expressed in gcm/s^2 .

The results of our further calculations showed that gravitational force between the first body mass M_1 and the second body mass $M_2 F_{1-2}$ in the formulas (1), (2) and (3) is maximal at the contact between these bodies. The force of gravitation between the first body mass M_1 and the second body mass $M_2 F_{1-2}$ decreases according to increasing the squared distance between them R_{1-2}^2 . The force of gravitation between the first body mass M_1 and the second body mass $M_2 F_{1-2}$ in the formulas (1), (2) and (3) becomes equal to the formula (6) when the distance between them reaches $R_{1-2} = 2 \times 2.034 \times 10^{17} \text{ cm}$ (squared Earth radius $R_{ear}^2 = (6.378 \times 10^8)^2 = 2 \times 2.034 \times 10^{17} \text{ cm}$). Then the gravitational force between the first body mass M_1 and the second body mass $M_2 F_{1-2}$ decreases to 0.00 gcm/s^2 according to the increase of the squared distance between them R_{1-2}^2 . It occurs because the force of gravitation F_{1-2} in the formulas (1), (2) and (3) is equal to the sum of two forces, while the formula (6) is only one force.

Physical nature of the distance $R_{1-2} = 2 \times 2.034 \times 10^{17} \text{ cm}$ and the method of determining the parameters of gravitational waves that are generated by all the objects in the Universe [21], will be shown in another work.

The second bodyweight P_2 was found by the formula

$$P_2 = M_2 \times g_1, \tag{6}$$

Where P_2 - is the second body weight, gcm/s^2

M_2 - is the second body mass, g;

g_1 - is the first body gravity acceleration, cm/s^2 .

It is reasonable to use formula (6) for obtaining the second body weight P_2 (weight standard-copy weight $P_{sta} = 1000.0 \text{ gcm/s}^2$ in TGT (1.0 kg in SI), etc.) only on the surface of the first body (the Earth g_{ear} , etc.) with gravity acceleration g_1 having the same radius as that of the Earth. To define the second body weight P_2 (weight standard-copy weight $P_{sta} = 1000.0 \text{ gcm/s}^2$ in TGT (1.0 kg in SI), etc.) on the surface of the Sun, the Moon, Mars, etc. or any other body, the radius of which is longer or shorter than the Earth radius, it is reasonable to use formulas (1), (2), (3) or (4).

The first body weight - is the product of the first body density (specific gravity) ρ_1 by the first body volume V_1 found by the formula (7) expressed in gcm/s^2 .

The first body weight P_1 of was found by the formula

$$P_1 = \rho_1 \times V_1, \tag{7}$$

Where P_1 - is the first body weight, gcm/s^2 ;

ρ_1 - is density (specific gravity) of the first body, g/cm^3 ;

V_1 - is the first body volume, cm^3 .

It is reasonable to use formula (7) for obtaining the body weight of bodies in the space and for finding the second body weight on the surface of the first body that has different radii.

The first body mass - is the matter in an abstract form as a component of the body weight equal to the relation of the first

body weight P_1 (weight standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $P_{sta} = 2.667 \times 10^{-22} \text{ gcm/s}^2$, the Earth weight $P_{ear} = 3.750 \times 10^{27} \text{ gcm/s}^2$, the Sun weight $P_{sun} = 4.156 \times 10^{38} \text{ gcm/s}^2$, the Moon weight $P_{moo} = 4.136 \times 10^{24} \text{ gcm/s}^2$, etc.) to gravity acceleration of the first body g_1 (standard-copy weight gravity acceleration 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $g_{sta} = 2.615 \times 10^{-22} \text{ cm/s}^2$, to the Earth gravity acceleration $g_{ear} = 980.665 \text{ cm/s}^2$, to the Sun gravity acceleration $g_{sun} = 3.265 \times 10^8 \text{ cm/s}^2$, to the Moon gravity acceleration $g_{moo} = 19.19 \text{ cm/s}^2$, etc.) equal to the first body mass M_1 (the mass standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $M_{sta} = 1.0197 \text{ g}$, the Earth mass $M_{ear} = 3.824 \times 10^{24} \text{ g}$, the Sun mass $M_{sun} = 1.273 \times 10^{30} \text{ g}$, the Moon mass $M_{moo} = 7.483 \times 10^{22} \text{ g}$, etc.), determined with the help of the mass standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $M_{sta} = 1.0197 \text{ g}$ and gravity acceleration of standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $g_{sta} = 2.615 \times 10^{-22} \text{ gcm/s}^2$, which are unchangeable for the standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 in SI), of the Earth, the Sun, the Moon, etc., having only one property of gravity acceleration and having no action boundaries, aggregate state, volume, density (specific gravity), temperature, odour (smell), color, and other properties that can have various values and is determined by the formula (8) and other TGT formulas, expressed in g .

The first body mass of a body M_1 was found by the formula

$$M_1 = \frac{P_1}{g_1} \tag{8}$$

Where M_1 - is the first body mass, g ;

P_1 - is the first body weight, gcm/s^2 ;

g_1 - is the first body gravity acceleration, cm/s^2 .

It is reasonable to use formula (8) for obtaining masses of various bodies that have different radii.

Gravity acceleration constant of 1.0g of body g_1^M - is the first body gravity acceleration $g_1 = 2.5645 \times 10^{-22} \text{ cm/s}^2$, created by the first body mass $M_1 = 1.0 \text{ g}$ on its surface defined by the formula (9) and other TGT formulas, expressed in cm/g^2 .

Gravity acceleration constant of 1.0g of body g_1^M was found by the formula

$$g_1^M = \frac{g_1}{M_1} \tag{9}$$

Where g_1^M - is the gravity acceleration constant of 1.0g of body, cm/g^2 ;

g_1 – is the first body gravity of acceleration, cm/s^2 ;
 M_1 – is the first body mass, g .

It is reasonable to use formula (9) to define the gravity acceleration of the body with mass 1.0g and having different radii.

Gravity acceleration of the first body g_1 –is the product of the first body mass M_1 by gravity acceleration constant 1.0g of body g_1^M that is defined by formula (10) and other TGT formulas, expressed in cm/s^2 .

$$g_1 = M_1 \times g_1^M, \quad (10)$$

Where g_1 – is the first body gravity acceleration, cm/s^2 ;

M_1 –is the first body mass, g ;

g_1^M –is gravity acceleration constant of 1.0g of body, cm/g_s^2 .

It is reasonable to use (10) to define the gravity acceleration of various bodies having different radii.

The first body gravity acceleration –is the relation of the first body weight P_1 to the first body mass defined M_1 by formula (11) and by other TGT formulas, expressed in cm/s^2

The body gravity acceleration g_1 , was found by the formula

$$g_1 = \frac{P_1}{M_1}, \quad (11)$$

Where g_1 –is the first body gravity of acceleration, cm/s^2 ;

P – is the first body weight, gcm/s^2 ;

M_1 –is the first body mass, g .

It is reasonable to use formula (11) to define the gravity acceleration of various bodies having different radii.

Density (specific gravity) of the first body –is the relation of the first body weight P_1 to the volume of the first body V_1 , that is defined by the formula (12) and by other TGT formulas, expressed by g/cm^2s^2 .

Density (specific gravity) of the first body ρ_1 was found by the formula

$$\rho_1 = \frac{P_1}{V_1}, \quad (12)$$

Where ρ_1 –is the first body density (specific gravity), g/cm^2s^2 ;

P_1 – is the first body weight, gcm/s^2

V_1 – is the first body volume, cm^3 .

It is reasonable to use formula (12) to define the density (specific gravity) of various bodies having different radii.

Density (specific gravity) of the first body ρ_1 was found by the formula

$$\rho_1 = \frac{\rho_{1-2} \times g_1}{g_2}, \quad (13)$$

Where ρ_1 –is the first body density (specific gravity), g/cm^2s^2 ;

ρ_{1-2} –is the first body density (specific gravity) taking into account the second body gravity acceleration, g/cm^2s^2 ;

g_1 –is the first body gravity acceleration, cm/s^2 ;

g_2 –is the second body gravity of acceleration, cm/s^2 .

It is reasonable to use the formula (13) to define the density (specific gravity) of the first body taking into account the second body gravity acceleration.

Physical nature and methods of obtaining mass, gravitational constant, gravity acceleration, velocity, first cosmic velocity, distance, gravitational radius and other parameters of different bodies with the help of physical and astrophysical constants according to TGT will be shown in some other work.

The elaboration of TGT was carried out with the help of Centimeter–Gram–Second System (CGS) and the data of NASA [22].

First, the parameters of the Earth were defined.

The Earth mass M_{ear} , could be found by formula (8). However, to do this it was necessary to find the Earth weight P_{ear} on the basis of the assumed average density (specific gravity) of the Earth.

The average Earth density (specific gravity) was found proceeding from the fact that the Earth rotates. Melted magma rotates with it. That's why in its centre, as in a milk separator there, are concentrated the lightest fractions of magma containing a sufficient quantity of gases (the approximate density (specific gravity) $1.502.50 g/cm^2s^2$). At the same time centrifugal forces press to the Earth crust some heavier magma fractions (the approximate density (specific gravity) $3.50 \sim 4.50 g/cm^2s^2$), that appear on the Earth surface during the eruption of volcanos. Taking into account the average density (specific gravity) of magma in the inner core, the average density (specific gravity) of the Earth's crust and water it was assumed that the Earth average density (specific gravity) is $\rho_{ear} = 3.45 g/cm^2s^2$.

The Earth weight was found proceeding from the fact that it attracts itself.

The Earth weight M_{ear} was found as the product of the assumed average density (specific gravity) of the Earth $\rho_{ear} = 3.45 g/cm^2s^2$ by the Earth volume V_{ear} by formula (7)

$$P_{ear} = \rho_{ear} \times V_{ear} = 3.45 \times 1.087 \times 10^{27} = 3.750 \times 10^{27} gcm/s^2. \quad (14)$$

Our further calculations showed that for defining the weights of the Earth, the Sun, the Moon, etc. in the state of weightlessness one doesn't need scales a dynamometer.

The Earth mass M_{ear} was found as the relation of the Earth weight P_{ear} to the Earth gravity acceleration g_{ear} by formula (8)

$$M_{ear} = \frac{P_{ear}}{g_{ear}} = \frac{3.750 \times 10^{27}}{980.665} = 3.824 \times 10^{24} g. \quad (15)$$

The Earth gravity acceleration g_{ear} was found as the relation of the

Earth weight P_{ear} to the Earth mass M_{ear} by formula (11)

$$g_{ear} = \frac{P_{ear}}{M_{ear}} = \frac{3.750 \times 10^{27}}{3.824 \times 10^{24}} = 980.665 \text{ cm/s}^2. \quad (16)$$

The force of gravitation between the first body with mass M_1 gravity acceleration g_1 and the second body with mass M_2 , gravity acceleration g_2 , placed at the distance between $R_{1-2}^2 F_{1-2}$ was found by means of substitution of mass M_1 in formulas (1), (2) and (3) by the so-called mass $M_1 = 1.0g$ in SI ($M_1 = 1.0kg$ in SI), mass M_2 by so-called mass $M_2 = 1.0g$ in SI ($M_2 = 1.0kg$ in SI) and gravity acceleration g_1 and g_2 by the known values according the doubtful Newtonian gravitation theory. However while defining the force of gravitation between different bodies, the results were always absurd. It means that the known parameters created with the help of the so-called mass $1.0g$ in SI ($M_2 = 1.0kg$ in SI), (newton, joule, watt, pascal, coulomb, volt, mole, etc.) don't correspond to reality. The notions and other measurement units such as (pound, torque, moment, British thermal unit (BTU), calorie, horsepower (hp), thrust, thrust-to-weight ratio, Reynolds number (Re), aerodynamic force, kilowatt hour, irradiance, etc.), don't correspond to reality either.

That's why, in the process of determining the Earth parameters the gravity acceleration constant was defined as $1.0g$ of body g_1^M .

Gravity accelerations constant $1.0g$ of body g_1^M was found as the relation of the Earth gravity acceleration g_{ear} to the Earth mass M_{ear} by the formula (9)

$$\frac{g_{ear}}{M_{ear}} = \frac{980.665}{3.824 \times 10^{24}} = 2.5645 \times 10^{-22} \text{ cm/g}^2. \quad (17)$$

The further calculations showed that this physical and astrophysical constant characterizes the masses of all the bodies in the Universe. Using gravity acceleration constant of $1.0g$ of body g_1^M made it possible to find the gravity acceleration of any body by the formula (10).

The Earth gravity acceleration g_{ear} was found as the product of the Earth mass M_{ear} by gravity acceleration constant of $1.0g$ of body g_1^M by the formula (10)

$$g_{ear} = M_{ear} \times g_1^M = 3.824 \times 10^{24} \times 2.5645 \times 10^{-22} = 980.665 \text{ cm/s}^2. \quad (18)$$

After measuring the Earth weight, mass and gravity acceleration it became necessary to measure the gravitational constant.

Gravitational constant G was sought by determining the force of gravitation between the Earth mass M_{ear} and the mass of the standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $M_{sta} F_{ear-sta}$, placed at the distance of the squared radius of the Earth R_{ear}^2 by the formula (1)

$$F_{ear-sta} = G \times \frac{M_{ear} \times g_{sta} + M_{sta} \times g_{ear}}{R_{ear}^2}, \quad (19)$$

Where $F_{ear-sta}$ – is the force of gravitation between the Earth and weight standard-copy 1000.0 gcm/s^2 in TGT (1.0 kg in SI), gcm/s^2 ;

G – is gravitational constant, cm^2 ;

M_{ear} – is the Earth mass, g ;

M_{sta} – is the standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI), g ;

g_{ear} – is the Earth gravity acceleration, cm/s^2 ;

g_{sta} – is standard-copy weight gravity acceleration 1000.0 gcm/s^2 in TGT (1.0 kg in SI), cm/s^2 ;

R_{ear} – is the Earth radius, cm .

The mass of standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) M_{sta} was found as the relation of weight of standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) P_{sta} to the Earth gravity acceleration g_{ear} by the formula (8)

$$M_{sta} = \frac{P_{sta}}{g_{ear}} = \frac{1000.0}{980.665} = 1.0197g. \quad (20)$$

The standard-copy gravity acceleration of the weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) g_{sta} was found as the product of the mass of standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) M_{sta} by gravity acceleration of $1.0g$ of body g_1^M by the formula (10)

$$g_{sta} = M_{sta} \times g_1^M = 1.0197 \times 2.5645 \times 10^{-22} = 2.615 \times 10^{-22} \text{ cm/s}^2. \quad (21)$$

This resulted in obtaining an equation with two unknowns: the force of gravitation between the Earth and the standard-copy weight 1000.0 gcm/s^2 in TGT (1.0kg in SI) $F_{ear-sta}$ and gravitational constant G . It was necessary to get rid of one of these two unknowns.

Gravitational constant G was sought by the substitution in formula (1) the force of gravitation between the first body with mass M_1 and the second body with mass M_2 placed at the distance of $R_{1-2}^2 F_{1-2}$ by the force of gravitation between the first body with mass $M_1 = 1.0g$ SI and the second body with mass $M_2 = 1.0g$ SI, placed at the distance $R_{1-2} = 1.0 \text{ cm} F_{1-2} = 6.67384 \times 10^{-8} \text{ cm}^3/\text{gcm}^2$ found by Cavendish. However, determining gravitation forces between various bodies gave absurd results each time.

Our further calculations showed that the force of gravitation in Cavendish experiment is in fact equal to $F_{1-2} = 1.0847 \times 10^{-10} \text{ gcm/s}^2$ and is not gravitational constant.

The physical nature and the method of determining this force Cavendish experiment will be shown in another work.

The weight of the standard-copy weight $P_{sta} = 1000.0 \text{ gcm/s}^2$ in TGT (1.0 kg in SI) was used for obtaining gravitational constant.

Centrifugal force of standard-copy weight $F_{sta} = 1000.0 \text{ gcm/s}^2$ in TGT (1.0 kg in SI) on the Earth surface $F_{ear-sta}$ was found as the relation of the product of the mass of the standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) M_{sta} by the squared first cosmic velocity of the Earth $V_{ear-fcv}^2 = (7.944 \times 10^5)^2 \text{ cm}^2/\text{s}^2$ to the Earth radius $R_{ear} = 6.378 \times 10^8 \text{ cm}$ by the formula (4)

$$F_{ear-sta} = \frac{M_{sta} \times V_{ear-fcv}^2}{R_{ear}} = \frac{1.0197 \times (7.944 \times 10^5)^2}{6.378 \times 10^8} = 1000.0 \text{ gcm/s}^2. \quad (22)$$

In the process of determining gravitational constant G we proceeded from the assumption that any second body with smaller mass M_2 moving round the first body with larger mass M_1 experiences not only the attraction of this body but also centrifugal force (4), that repulses the second body from the first one.

The force of gravitation between the Sun and any planet (asteroid, comet, etc.) is to be equal to the centrifugal force of each planet (asteroid, comet, etc.). If they weren't equal, all the planets (asteroids, comets, etc.) would fall down on the Sun or flow away to the outer space.

Thus, the formula (1) was equated to the formula (4).

$$G \times \frac{M_1 \times g_2 + M_2 \times g_1}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}} \quad (23)$$

The force of gravitation between the Earth mass M_{ear} and the standard-copy weight 1000.0 gcm/s^2 in TGT (1.0kg in SI) $M_{sta} F_{ear-sta}$, found by the formula (19), was equated to centrifugal force of the standard-copy weight 1000.0 gcm/s^2 in TGT (1.0kg in SI) on the surface of the Earth $F_{ear-sta}$, found by the formula (22)

$$G \times \frac{M_{ear} \times g_{sta} + M_{sta} \times g_{ear}}{R_{ear}^2} = \frac{M_{ear} \times V_{ear-fcv}^2}{R_{ear}}. \quad (24)$$

It resulted in getting rid of one of two unknowns and obtaining an equation only with one unknown that is with-gravitational constant G

$$G \times \frac{3.824 \times 10^{24} \times 2.615 \times 10^{-22} + 1.0197 \times 980.665}{(6.378 \times 10^8)^2} = \frac{1.0197 \times (7.944 \times 10^5)^2}{6.378 \times 10^8} \quad (25)$$

or

$$G \times \frac{3.824 \times 10^{24} \times 2.615 \times 10^{-22} + 1.0197 \times 980.665}{(6.378 \times 10^8)^2} = 1.0197 \times 980.665. \quad (26)$$

Having solved the equation (23) relatively to G we obtained

$$G = \frac{M_2 \times R_{1-2} \times V_2^2}{M_1 \times g_2 + M_2 \times g_1}. \quad (27)$$

Gravitational constant G was found proceeding from the mass standard-copy weight 1000.0 gcm/s^2 in TGT (1.0kg in SI) M_{sta} , the Earth radius R_{ear} , the squared Earth first cosmic velocity $V_{ear-fcv}^2$, the Earth mass M_{ear} , gravity acceleration of standard-copy weight of 1000.0 gcm/s^2 in TGT (1.0 kg in SI) g_{sta} and the Earth gravity acceleration g_{ear} by the formula (27)

$$G = \frac{M_{sta} \times R_{ear} \times V_{ear-fcv}^2}{M_{ear} \times g_{sta} + M_{sta} \times g_{ear}} = \frac{1.0197 \times 6.378 \times 10^8 \times (7.944 \times 10^5)^2}{3.824 \times 10^{24} \times 2.615 \times 10^{-22} + 1.0197 \times 980.665} = 2.034 \times 10^{17} \text{ cm}^2. \quad (28)$$

After obtaining gravitational constant G it became clear that for this one needs neither mountain Schiehallion; torsion balance of John Michell; nor lead, gold, platinum or optical glass balls, etc.; lead ingots, steel cylinders; flasks with mercury; melted tungsten wire or melted quartz fiber, etc.; pendulums; weightlessness, etc. [23].

Gravitational constant—is the area of the half of radial section of

the gravitational field having the form of the curved shape area that is equal to the rectangle area with the length $R_{G1} = 2.034 \times 10^{17} \text{ cm}$ and the height $R_{G2} = 1.0 \text{ cm}$, which rotates with an acceleration $g_G = 1.0 \text{ cm/s}^2$, which generates around itself the first body with mass $M_1 = 1.9497 \times 10^{21} \text{ g}$, and with the gravity acceleration $g_1 = 0.5 \text{ cm/s}^2$, which is equal to $2.034 \times 10^{17} \text{ cm}^2$, expressed in cm^2 .

Physical nature and the methods of defining gravitational constant and other physical and astrophysical constants with the help of other physical and astrophysical constants according to TGT will be shown in another work.

The definition of gravitational constant G showed that weight of standard-copy weight of 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $P_{sta} = 1000.0 \text{ gcm/s}^2$ and the mass of standard-copy weight 1000.0 gcm/s^2 in TGT (1.0 kg in SI) $M_{sta} = 1.0197 \text{ g}$ on the basis of the known standard-copy of 1.0kg in SI may be used before the formation of Tsiganok measuring system is completed. Tsiganok measuring system with new constant standard-copies will make it possible to replace the insufficiently grounded International System of Units (SI), Centimeter-gram-second system of units (CGS), Imperial and US customary units, etc. Moreover, most of the constant standards-copies in this system will be valid within the limits of the whole Universe, not only within the borders of separate states or branches on the Earth. When the creation of Tsiganok measurement system is completed there must be minted the medal with the known motto of Condorcet. "Atous les temps, à tous les peuples".

The average density (specific gravity) of the Earth was found proceeding from the equality $M_1 \times g_2 = M_2 \times g_1$ in the formulas (1), (2) and (3). First, there were found the Earth weight P_{ear} , the Earth mass M_{ear} and gravitational constant G with the help of the Earth assumed density (specific gravity) $\rho_{ear} = 3.40 \text{ g/cm}^2 \text{ s}^2$. In the process of calculations it was taken into account that the average distance from the Sun to the Earth $R_{sun-ear}$, the average distance from the Earth to the Moon $R_{ear-moo}$, the Earth gravity acceleration g_{ear} and some other parameters were found experimentally, so the validity of these parameters was doubtless. In defining the gravitational force between the Sun and the Earth and between the Earth and the Moon, etc. the equality $M_1 \times g_2 = M_2 \times g_1$ in the formula (1), (2) and (3) turned out to be violated. Only after increasing the average density (specific gravity) of the Earth from $\rho_{ear} = 3.40 \text{ g/cm}^2 \text{ s}^2$ to $\rho_{ear} = 3.45 \text{ g/cm}^2 \text{ s}^2$ the equality $M_1 \times g_2 = M_2 \times g_1$, in the formulas (1), (2), and (3) was achieved.

This equality $M_1 \times g_2 = M_2 \times g_1$ made it possible to obtain the exact value of the gravitational constant $G = 2.034 \times 10^{17} \text{ cm}^2$.

In the process of TGT elaboration it was taken into account that some parameters of bodies always remain constant irrespective of the point of the Universe they are located while the value of others may change sufficiently. Thus, for example, the weight, mass, gravity acceleration and some other parameters of a given body won't change if it is moved from one point of the outer space to another. At the same time, for example, the average density (specific gravity) and some other parameters of the same body may change sufficiently if they are found in the conditions of other body gravity acceleration. So, for example,

the weight and the average density (specific gravity) of a given body may be found in the conditions of gravity acceleration of the same body. However, these parameters may be found in the conditions of the Earth gravity acceleration or gravity acceleration of any other body. Our further calculations showed, for example, that the average density (specific gravity) of lunar soil, in the conditions of the Moon gravity acceleration is equal to $\rho_{moo} = 0.065 \frac{g}{cm^2 s^2}$. However, the same average density (specific gravity) of lunar soil, delivered by the American astronauts to the surface of the Earth in the conditions of the Earth gravity acceleration, turned out to be, equal to $\rho_{moo-ear} = 3.34 \frac{g}{cm^2 s^2}$.

Such calculations are necessary for defining the average density (specific gravity) of the Earth soil on the surface of the Sun, Mars, Jupiter, etc. and vice versa. Such calculations are also necessary for defining the average density (specific gravity), weight, mass, engines thrust and other parameters of space vehicles on the surface of the Moon, Mars, Jupiter, etc., as well as in the space.

This statement can be illustrated by the example of finding the weight, mass, gravity acceleration and average density (specific gravity) of the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water on the surface of the Earth and in the space.

The weight of the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water on the Earth surface in the conditions of the Earth gravity acceleration is equal to $P_{sta} = 1000.0 \frac{gcm}{s^2}$.

The mass standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water M_{sta} was found as the relation of standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water on the Earth surface P_{sta} to the Earth gravity acceleration g_{ear} by the formula (8)

$$M_{sta} = \frac{P_{sta}}{g_{ear}} = \frac{1000.0}{980.665} = 1.0197g. \quad (29)$$

Then the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water was delivered to the space.

The gravity acceleration of standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space g_{sta} was found as the product of mass standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space M_{sta} by constant of gravity acceleration of 1.0g of body g_1^M by the formula (10)

$$g_{sta} = M_{sta} \times g_1^M = 1.0197 \times 2.5645 \times 10^{-22} = 2.615 \times 10^{-22} \frac{cm}{s^2}. \quad (30)$$

The weight of the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space $P_{sta-spa}$ was found as the product of the mass standard-copy weight $1000.0 \frac{gcm}{s^2}$

in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space M_{sta} by the gravity acceleration standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space g_{sta} by the formula (5)

$$P_{sta-spa} = M_{sta} \times g_{sta} = 1.0197 \times 2.615 \times 10^{-22} = 2.667 \times 10^{-22} \frac{gcm}{s^2}. \quad (31)$$

The average density (specific gravity) of the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space $\rho_{sta-spa}$ was found as the relation of the weight of the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space $P_{sta-spa}$ to the volume of standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space V_{sta} by the formula(12)

$$\rho_{sta-spa} = \frac{P_{sta-spa}}{V_{sta}} = \frac{2.667 \times 10^{-22}}{1000.0} = 2.667 \times 10^{-25} \frac{g}{cm^2 s^2}. \quad (32)$$

The average density (specific gravity) of the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water on the surface of the Earth ρ_{sta} was found as the relation of the weight of the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water on the surface of the Earth P_{sta} to the volume of standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water on the surface of the Earth V_{sta} by the formula(12)

$$\rho_{sta} = \frac{P_{sta}}{V_{sta}} = \frac{1000.0}{1000.0} = 1.0 \frac{g}{cm^2 s^2}. \quad (33)$$

The average density (specific gravity) of the standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water on the surface of the Earth ρ_{sta} was found proceeding from the average density (specific gravity) of standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space $\rho_{sta-spa}$, the Earth gravity acceleration g_{ear} and the gravity acceleration of standard-copy weight $1000.0 \frac{gcm}{s^2}$ in TGT (1.0 kg in SI) $V_{sta} = 1000.0cm^3$ of distilled water in the space $g_{sta-spa}$ by the formula (13)

$$\rho_{sta} = \frac{\rho_{sta-spa} \times g_{ear}}{g_{sta-spa}} = \frac{2.667 \times 10^{-25} \times 980.665}{2.615 \times 10^{-22}} = 1.0 \frac{g}{cm^2 s^2}. \quad (34)$$

After determining the Earth parameters and the gravitational constant G, the measurement of the Sun parameters started. The Sun parameters could be found by the formulas (7), (8) and (11) by analogy to the Earth parameters. However, the Sun is in the state of plasma. That's why the delivery of the samples of solar soil to the Earth is quite problematic. So, taking into account that $g_1 = M_1 \times g_1^M$ the formula (1) was written in the following way

$$F_{1-2} = G \frac{M_1 \times g_2 + M_2 \times M_1 \times g_1^M}{R_{1-2}^2}. \quad (35)$$

This resulted in obtaining an equation with two unknowns: the force of gravitation between the first and second bodies F_{1-2} and the first body mass M_1 . It was necessary to get rid of one of these two unknowns. To do this, the formula (35) was equated to the formula (4)

$$G \times \frac{M_1 \times g_2 + M_2 \times M_1 \times g_1^M}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}}. \quad (36)$$

When the equation (36) relatively to M_1 , was solved, there was obtained

$$M_1 = \frac{M_2 \times R_{1-2} \times V_2^2}{G \times (g_2 + M_2 \times g_1^M)}. \quad (37)$$

Using the formula (37) it became possible to find the unknown first body parameters by the second body known parameters.

First of all there were the attempts to clear out whether the left side of the equation (36) is equal to the right one. Taking into account that $g_1 = M_1 \times g_1^M$, that $g_2 = M_2 \times g_1^M$ the formula (36) was written in such a form

$$G \times \frac{M_1 \times M_2 \times g_1^M + M_2 \times M_1 \times g_1^M}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}} \quad (38)$$

or

$$\frac{2 \times G \times M_1 \times M_2 \times g_1^M}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}}. \quad (39)$$

Taking into account that

$$V_1^M = 2 \times G \times g_1^M = 2 \times 2.034 \times 10^{17} \times 2.5645 \times 10^{-22} = 1.04324 \times 10^{-4} \text{ cm}^3/\text{gs}^2, \quad (40)$$

Where V_1^M - is body gravitational field constant of 1.0g of body, cm^3/gs^2

the formula (39) was written in the following way

$$\frac{M_1 \times M_2 \times V_1^M}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}} \quad (41)$$

or

$$\frac{M_1 \times M_2 \times 1.0432386 \times 10^{-4}}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}}. \quad (42)$$

Taking into account that, as it will be shown later, $V_B^M = M_1 \times 1.04324 \times 10^{-4}$, where V_B^M - is the body gravitational field constant, cm^3/s^2 the formula (42) was written in the following way

$$\frac{M_2 \times V_B^M}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}}. \quad (43)$$

Taking into account that, as it will be shown in another paper $V_B^M = R_{1-2} \times V_2^2$, the formula (43) was written in the following way

$$\frac{M_2 \times R_{1-2} \times V_2^2}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}}. \quad (44)$$

If R_{1-2} in the left side of equality (44) is cancelled, one will obtain two absolutely equal formulas

$$\frac{M_2 \times V_2^2}{R_{1-2}} = \frac{M_2 \times V_2^2}{R_{1-2}}. \quad (45)$$

It means that the formula (36), including $G, M_1, M_2, g_1^M, g_2, R_{1-2}^2$ is equal to the formula (4), including M_2, V_2^2 и R_{1-2} . It means that in the process of creating Newton doubtful theory of gravitation, the unknown masses were cancelled when solving the equation $G \times \frac{M_2 \times M_2}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}}$. It also means that in the process of creating Tsiganok gravitation theory, in solving the equation (23) there were cancelled the known masses.

Physical nature and the methods of determining gravitational field constant of 1.0g body V_1^M and body gravitational field constant V_B^M as well as other physical and astrophysical constants according to TGT will be shown in another work.

The force of gravitation between the Sun and the Earth $F_{\text{sun-ear}}$ was found to confirm the formula (1) practically. Taking into account that $g_{\text{sun}} = M_{\text{sun}} \times g_1^M$ the formula (35) was written in the following way

$$F_{\text{sun-ear}} = G \times \frac{M_{\text{sun}} \times g_{\text{ear}} + M_{\text{ear}} \times M_{\text{sun}} \times g_1^M}{R_{\text{sun-ear}}^2}, \quad (46)$$

Where $F_{\text{sun-ear}}$ - is the force of gravitation between the Sun and the Earth, gcm/s^2 ;

G - is gravitational constant, cm^2 ;

M_{sun} - is the Sun mass, g

M_{ear} - is the Earth mass, g ;

g_{ear} - is the Earth gravity acceleration, cm/s^2 ;

g_1^M - is gravity acceleration constant 1.0g body, cm/gs^2 ;

$R_{\text{sun-ear}}$ - is the distance from the Sun to the Earth, cm .

This resulted in obtaining an equation with two unknowns: the force of gravitation between the Sun and the Earth $F_{\text{sun-ear}}$ and the Sun mass M_{sun} . It was necessary to get rid of one of these two unknowns. In this case we proceeded from the fact that the Earth moving along its orbit round the Sun experiences not only the gravitation of the Sun but also the centrifugal force that repulses the Earth from the Sun.

The Earth centrifugal force $F_{\text{sun-ear}}$ was found as the relation of the product of the Earth mass M_{ear} by the squared average orbital velocity of the Earth V_{ear}^2 to the average distance from the Sun to the Earth by the formula (4)

$$F_{\text{sun-ear}} = \frac{M_{\text{ear}} \times V_{\text{ear}}^2}{R_{\text{sun-ear}}} = \frac{3.824 \times 10^{24} \times (2.979 \times 10^6)^2}{1.496 \times 10^{13}} = 2.268 \times 10^{24} \text{ gcm}/\text{s}^2. \quad (47)$$

The force of gravitation between the Sun and the Earth $F_{\text{sun-ear}}$,

found by the formula (46), was equated to the Earth centrifugal force $F_{sun-ear}$, found by the formula (47).

$$G \times \frac{M_{sun} \times g_{ear} + M_{ear} \times M_{sun} \times g_1^M}{R_{sun-ear}^2} = \frac{M_{ear} \times V_{ear}^2}{R_{sun-ear}}. \quad (48)$$

This resulted in obtaining an equation with only one unknown that is the Sun mass M_{sun}

$$2.034 \times 10^{17} \times \frac{M_{sun} \times 980.665 + 3.824 \times 10^{24} \times M_{sun} \times 2.5645 \times 10^{-22}}{(1.496 \times 10^{13})^2} = \frac{3.824 \times 10^{24} \times (2.979 \times 10^6)^2}{1.496 \times 10^{13}} \quad (49)$$

or

$$2.034 \times 10^{17} \times \frac{M_{sun} \times 980.665 + 3.824 \times 10^{24} \times M_{sun} \times 2.5645 \times 10^{-22}}{(1.496 \times 10^{13})^2} = 3.824 \times 10^{24} \times 0.5933. \quad (50)$$

The Sun mass M_{sun} was found proceeding from the average distance from the Sun to the Earth $R_{sun-ear}$, the average squared orbital velocity of the Earth V_{ear}^2 , the Earth mass M_{ear} , the gravitational constant G , the Earth gravity acceleration g_{ear} and gravity acceleration constant of 1.0g body g_1^M by the formula (37)

$$M_{sun} = \frac{M_{ear} \times R_{sun-ear} \times V_{ear}^2}{G \times (g_{ear} + M_{ear} \times g_1^M)} = \frac{3.824 \times 10^{24} \times 1.496 \times 10^{13} \times (2.979 \times 10^6)^2}{2.043 \times 10^{17} \times (980.665 + 3.824 \times 10^{24} \times 2.5645 \times 10^{-22})} = 1.273 \times 10^{30} \text{ g}. \quad (51)$$

Other Sun parameters were measured after defining the Sun mass M_{sun} .

The Sun gravity acceleration g_{sun} was defined as the product of the Sun mass M_{sun} by gravity acceleration constant 1.0g of body g_1^M by the formula (10)

$$g_{sun} = M_{sun} \times g_1^M = 1.273 \times 10^{30} \times 2.5645 \times 10^{-22} = 3.265 \times 10^8 \text{ cm/s}^2. \quad (52)$$

The force of gravitation between the Sun and the Earth $F_{sun-ear}$ was found by the formula (1)

$$F_{sun-ear} = G \times \frac{M_{sun} \times g_{sun} + M_{ear} \times g_{sun}}{R_{sun-ear}^2} = 2.034 \times 10^{17} \times \frac{1.273 \times 10^{30} \times 980.665 + 3.824 \times 10^{24} \times 3.265 \times 10^8}{(1.496 \times 10^{13})^2} = 2.269 \times 10^{21} \text{ gcm/s}^2. \quad (53)$$

The Earth centrifugal force $F_{sun-ear}$, found by the formula (4), turned out to be equal to the force of gravitation between the Sun and the Earth $F_{sun-ear}$, found by the formula (1), which shows the validity of these formulas.

The Sun weight P_{sun} was found as the product of the Sun mass M_{sun} by the Sun gravity acceleration by the formula (5)

$$P_{sun} = M_{sun} \times g_{sun} = 1.273 \times 10^{30} \times 3.265 \times 10^8 = 4.156 \times 10^{38} \text{ gcm/s}^2. \quad (54)$$

The Sun weight taking into account the Earth gravity acceleration $P_{sun-ear}$ was found as the product of the Sun mass M_{sun} by the Earth gravity acceleration g_{ear} by the formula (5)

$$P_{sun-ear} = M_{sun} \times g_{ear} = 1.273 \times 10^{30} \times 980.665 = 1.248 \times 10^{33} \text{ gcm/s}^2. \quad (55)$$

The Sun average density (specific gravity) ρ_{sun} was found as the relation of the Sun weight, P_{sun} to the Sun volume V_{sun} by the formula (12)

$$\rho_{sun} = \frac{P_{sun}}{V_{sun}} = \frac{4.156 \times 10^{38}}{1.413 \times 10^{33}} = 2.941 \times 10^5 \text{ g/cm}^2 \text{ s}^2. \quad (56)$$

The Sun average density (specific gravity), taking into account the Earth gravity acceleration $\rho_{sun-ear}$, was found as the relation of the Sun

weight taking into account the Earth gravity acceleration $P_{sun-ear}$ to the Sun volume V_{sun} by the formula (12)

$$\rho_{sun-ear} = \frac{P_{sun-ear}}{V_{sun}} = \frac{1.248 \times 10^{33}}{1.413 \times 10^{33}} = 0.833 \text{ g/cm}^2 \text{ s}^2. \quad (57)$$

The Sun average density (specific gravity) ρ_{sun} was found proceeding from the Sun average density (specific gravity) taking into account the Earth gravity acceleration $\rho_{sun-ear}$, the Sun gravity acceleration g_{sun} and the Earth gravity acceleration g_{ear} by the formula (13)

$$\rho_{sun} = \frac{\rho_{sun-ear} \times g_{sun}}{g_{ear}} = \frac{0.833 \times 3.265 \times 10^8}{980.665} = 2.940 \times 10^5 \text{ g/cm}^2 \text{ s}^2. \quad (58)$$

If we could take a sample of Solar soil from the Sun surface and deliver it to the Earth surface, then its average density (specific gravity) would be equal to the average density (specific gravity) of petroleum diesel $\rho_{diesel} = 0.832 \text{ g/cm}^2 \text{ s}^2$.

According to Newton doubtful gravitation theory, as many as 333000 masses of the Earth are necessary to obtain the mass of the Sun. In order to find the Sun gravity acceleration one needs 28 Earth gravity accelerations. It means that the Sun and the Earth are made up of atomic nuclei, neutrons, electrons, etc., which have different abilities to attract. According to TGT, 333000 Earth masses are needed to find the Sun mass and 333000 Earth gravity accelerations are needed to find the Sun gravity acceleration. It means that the Sun and the Earth are made up of atomic nuclei, neutrons, electrons, etc. that have the same ability to attract.

The Sun parameters were found with the help of the Earth centrifugal force (47).

The Sun parameters can be found without using the centrifugal force of the Earth, asteroids, comets, etc.

Physical nature and the method of obtaining the first body parameters, when there is no information about the centrifugal force of the second body rotating round the first body, with the help of physical and astrophysical constants according to TGT will be shown later in another work.

The Earth and the Sun parameters having been measured, there were obtained the parameters of the Moon.

The Moon parameters were found in the same way as the Earth parameters on the basis of the average density (specific gravity) of lunar soil delivered by the American astronauts to the Earth surface $P_{moo-ear} = 3.34 \text{ g/cm}^2 \text{ s}^2$.

The Moon weight taking into account the Earth gravity acceleration $P_{moo-ear}$ was found as the product of the Moon average density (specific gravity) taking into account the Earth gravity acceleration $\rho_{moo-ear}$ by the Moon volume V_{moo} by the formula (7)

$$P_{moo-ear} = \rho_{moo-ear} \times V_{moo} = 3.34 \times 2.197 \times 10^{25} = 7.338 \times 10^{25} \text{ gcm/s}^2. \quad (59)$$

The Moon mass M_{moo} was found as the relation of the Moon weight taking into account the Earth gravity acceleration $P_{moo-ear}$ to the Earth gravity acceleration g_{ear} by the formula (8)

$$M_{moo} = \frac{P_{moo-ear}}{g_{ear}} = \frac{7.338 \times 10^{25}}{980.665} = 7.483 \times 10^{22} g. \quad (60)$$

In this case it was taken into account that the Moon mass M_{moo} found proceeding from the lunar soil average density (specific gravity) taking into account the Earth gravity acceleration $\rho_{moo-ear}$, is equal to the Moon mass found proceeding from the lunar average soil density (specific gravity), taking into account the Moon gravity acceleration ρ_{moo} .

The Moon gravity acceleration g_{moo} was found as the product of the Moon mass M_{moo} by gravity acceleration constant of 1.0g of body g_1^M by the formula (10)

$$g_{moo} = M_{moo} \times g_1^M = 7.483 \times 10^{22} \times 2.5645 \times 10^{-22} = 19.19 \text{ cm/s}^2 \quad (61)$$

The Moon weight P_{moo} was found as the product of the Moon mass M_{moo} by the Moon gravity acceleration g_{moo} by the formula (5)

$$P_{moo} = M_{moo} \times g_{moo} = 7.483 \times 10^{22} \times 19.19 = 1.436 \times 10^{24} \text{ gcm/s}^2. \quad (62)$$

The Moon average density (specific gravity) ρ_{moo} was found as the relation of the Moon weight P_{moo} to the Moon volume V_{moo} by the formula (12)

$$\rho_{moo} = \frac{P_{moo}}{V_{moo}} = \frac{1.436 \times 10^{24}}{2.197 \times 10^{25}} = 0.065 \text{ g/cm}^2 \text{ s}^2. \quad (63)$$

The Moon average density (specific gravity) ρ_{moo} was found proceeding from the Moon average density (specific gravity) taking into account the Earth gravity acceleration $\rho_{moo-ear}$, the Moon gravity acceleration g_{moo} and the Earth gravity acceleration g_{ear} by the formula (13)

$$\rho_{moo} = \frac{\rho_{moo-ear} \times g_{moo}}{g_{ear}} = \frac{3.34 \times 19.19}{980.665} = 0.065 \text{ g/cm}^2 \text{ s}^2. \quad (64)$$

The Moon centrifugal force $F_{ear-moo}$ was found proceeding from the Moon mass M_{moo} , the Moon squared average orbital velocity V_{moo}^2 and the average distance from the Earth to the Moon $R_{ear-moo}$ by the formula (4)

$$F_{ear-moo} = \frac{M_{moo} \times V_{moo}^2}{R_{ear-moo}} = \frac{7.483 \times 10^{22} \times (1.023 \times 10^5)^2}{3.844 \times 10^{10}} = 2.038 \times 10^{22} \text{ gcm/s}^2. \quad (65)$$

The force of gravitation between the Earth and the Moon $F_{ear-moo}$ was found by the formula (1)

$$F_{ear-moo} = G \times \frac{M_{ear} \times g_{moo} + M_{moo} \times g_{ear}}{R_{ear-moo}^2} = 2.034 \times 10^{22} \times \frac{3.824 \times 10^{24} \times 19.19 + 7.483 \times 10^{22} \times 980.665}{(3.844 \times 10^{10})^2} = 2.020 \times 10^{22} \text{ gcm/s}^2. \quad (66)$$

The Moon centrifugal force $F_{ear-moo}$ found by the formula (65) turned out to be equal to the force of gravitation between the Earth and the Moon $F_{ear-moo}$ found by the formula (66)

$$2.034 \times 10^{22} \times \frac{3.824 \times 10^{24} \times 19.19 + 7.483 \times 10^{22} \times 980.665}{(3.844 \times 10^{10})^2} = \frac{7.483 \times 10^{22} \times (1.023 \times 10^5)^2}{3.844 \times 10^{10}} \quad (67)$$

or

$$2.034 \times 10^{22} \times \frac{3.824 \times 10^{24} \times 19.19 + 7.483 \times 10^{22} \times 980.665}{(3.844 \times 10^{10})^2} = 7.483 \times 10^{22} \times 0.2723. \quad (68)$$

The force of gravitation between the Earth and the Moon $F_{ear-moo}$ found by the formula (66) turned out to be equal to the Moon centrifugal force $F_{ear-moo}$ found by the formula (65), which shows the validity of these formulas.

The Moon parameters can be found without using the Moon average density (specific gravity).

The nature and the methods of defining the first body parameters, when the second body that rotates round the first one isn't available, without using physical and astrophysical constants according to TGT will be shown in another work.

Some results of our calculations are given in Table 1.

The weight, mass, gravity acceleration and average density (specific gravity) of standard-copy weight 1000.0 gcm/s² in TGT (1.0 kg in SI) $V_{sta} = 1000.0 \text{ cm}^3$ of the distilled water in the space, as well as those of the Earth, the Sun and the Moon.

In spite of the fact that the Earth and the Moon parameters were found proceeding from experimental data on average density (specific gravity) of these bodies, there remained some doubts as to the validity of the formulas (1), (2), (3), (4) and the equation (23).

It is problematic to confirm the validity of the formulas (1), (2) and (3) experimentally and to find the force of gravitation between the bodies in a laboratory on the Earth surface due to the lack of a dynamometer which could fix such an insufficient force. It appeared much more simple and obvious to confirm experimentally the validity of the formula (4) with the help of a dynamometer, a rope, a body and a stop-watch. The rotation of the Earth round the Sun and that

Body	P_1	M_1	g_1	\tilde{n}_1
	(gcm s ⁻²)	(g)	(cm s ⁻²)	(gcm ⁻² s ⁻²)
Standard-copy weight 1000.0 gcm/s ² in TGT (1.0 kg in SI) $V_{(sta)} = 1000.0 \text{ cm}^3$ of distilled water in space	2.667×10^{-22}	1.0197	2.615×10^{-22}	2.667×10^{-25}
The Earth	3.750×10^{27}	3.824×10^{24}	980.665	3.450
The Sun	4.156×10^{38}	1.273×10^{30}	3.265×10^8	2.941×10^5
The Moon	1.436×10^{24}	7.483×10^{22}	19.190	0.065

Table 1: Calculations showing weight, mass, gravity acceleration and average density in Space, Earth, Sun and Moon.

of the Moon round the Earth, etc. was replaced by the rotation of a dynamometer, a rope, a plastic bottle filled with water by the right hand. We took into account that the distance from the first body to the second body R_{1-2} , and the second body mass, M_2 in the left and of the right sides of the equation (23) are to be equal. If centrifugal force, which will be shown by the dynamometer in the process of the experiment on rotating body with mass M_2 will, coincide with centrifugal force F_{1-2} , found by the formula (4), according to TGT, it will mean that the second body mass M_2 in the left side on the equation (23) and the second body mass M_2 in the right side of the equation (23) are one and the same mass.

A number of experiments of rotating bodies with different weight and masses using the ropes of different length were carried out while elaborating TGT.

In such conditions the following circumstances were taken into account.

The expression the so-called of 1.0kg in SI according to Newton doubtful gravitation theory on dynamometer was corrected by 1000.0gcm/s² in TGT, 2.0kg SI by 2000.0gcm/s² in TGT, 3.0kg SI by 3000.0gcm/s² in TGT, etc.

It was necessary to substitute 1.0197g in TGT to the formula (4) instead of the so-called mass of 1.0kg in SI, and 2.039g in TGT instead of 2.0kg in SI to the formula (4), 3.059g in TGT instead of 3.0kg in SI, etc.

In our experiment the distance was counted from a ring, attached to a dynamometer, to the centre of gravity of the body, taking into account the length of the dynamometer, and that of the rope and the part of the body.

The experiment on measuring centrifugal force consisted in rotating three bodies (a dynamometer, a rope and a plastic bottle filled with water) by the right hand. In the process of rotating these bodies having different total weights and masses, the number of their rotations per minute and at different lengths of the rope was fixed by a stopwatch.

The first body with total weight $P_1 = 1000.0gcm/s^2$ in TGT or (1.0 kg in SI) was rotate during the rope having the length of $R_{1-1} = 50.0cm$, the frequency of rotation $f_1 = 67.0rpm$, the period of rotation $T_1 = 0.8955s$ and angular velocity $V_1 = 350.82cm/s$.

The second body with total weight $P_2 = 1000.0gcm/s^2$ in TGT or (1.0 kg in SI) was rotated using the rope having the length of $R_{1-2} = 100.0cm$, the frequency of rotation $f_2 = 54.0rpm$, the period of rotation $T_2 = 1.1112s$ and angular velocity $V_2 = 565.49cm/s$.

The third body with total weight $P_3 = 1500.0gcm/s^2$ in TGT or (1.5kg in SI) was rotated using the rope having the length of $R_{1-3} = 100.0cm$, the frequency of rotation $f_3 = 60.0rpm$, the period of rotation $T_3 = 1.0s$ and angular velocity $V_3 = 628.32cm/s$.

The first body mass M_1 with the total weight $P_1 = 1000.0gcm/s^2$ was found by the formula (8)

$$M_1 = \frac{P_1}{g_{ear}} = \frac{1000.0}{980.665} = 1.0197g. \quad (69)$$

The second body mass M_2 with the total weight $P_2 = 1000.0gcm/s^2$ was found by the formula (8)

$$M_2 = \frac{P_2}{g_{ear}} = \frac{1000.0}{980.665} = 1.0197g. \quad (70)$$

The third body mass M_3 with the total weight $P_3 = 1500.0gcm/s^2$ was found by the formula (8)

$$M_3 = \frac{P_3}{g_{ear}} = \frac{1500.0}{980.665} = 1.5296g. \quad (71)$$

The centrifugal force of the first body with mass $M_1 = 1.0197g$, centre of gravity of which rotated at the distance $R_{1-1} = 50.0cm$ from the axis of rotation with angular velocity $V_1 = 350.82cm/s$ F_{1-1} was found by the formula(4)

$$F_{1-1} = \frac{M_1 \times V_1^2}{R_{1-1}} = \frac{1.0197 \times 350.82^2}{50.0} = 2509.98gcm/s^2. \quad (72)$$

The centrifugal force of the second body with mass $M_2 = 1.0197g$, centre of gravity of which rotated at the distance $R_{1-2} = 100.0cm$ from the axis of rotation with angular velocity $V_1 = 565.49cm/s$ F_{1-2} was found by the formula(4)

$$F_{1-2} = \frac{M_2 \times V_2^2}{R_{1-2}} = \frac{1.0197 \times 565.49^2}{100.0} = 3260.79gcm/s^2. \quad (73)$$

The centrifugal force of the third body with mass $M_3 = 1.5296g$, centre of gravity of which rotated at the distance $R_{1-3} = 100.0cm$ from the axis of rotation with angular velocity $V_3 = 628.32cm/s$ F_{1-3} was found by the formula (4):

$$F_{1-3} = \frac{M_3 \times V_3^2}{R_{1-3}} = \frac{1.5296 \times 628.32^2}{100.0} = 6038.647gcm/s^2. \quad (74)$$

In the process of rotation of each of three bodies we didn't see the dynamometer readings. However, in our dynamometer, the hand moved along the scale and in the process of rotation of these bodies we could fix its hand by a finger. When the rotation of these three bodies finished (a dynamometer, a rope, a plastic bottle filled with water) we could record the dynamometer readings at different weight and masses and with rope of different lengths.

In such experiment the dynamometer readings coincided with theoretical calculations by the formulas (72), (73) and (74).

Then we checked the validity of Newton doubtful gravitation theory. For this, we substituted in the formulas (72), (73) and (74) instead of the first body mass $M_1 = 1.0197g$ in TGT, the second body mass $M_2 = 1.0197g$ in TGT and the third body mass $M_3 = 1.5296g$ in TGT, the so-called masses of the first body $M_1 = 1000.0g$ in SI, the second body $M_2 = 1000.0g$ in SI and the third body $M_3 = 1500.0g$ in SI according to the doubtful gravitation theory of Newton and the obtained results were absurd.

The results of our calculations according to TGT and also the

experiment on determining centrifugal force with the help of a dynamometer, a rope, a plastic bottle filled with water made it possible to formulate some conclusions.

If the centrifugal forces of the first body F_{1-1} , the second body F_{1-2} and the third body F_{1-3} y, which were found with the help of the so-called first body mass $M_1 = 1000.0g$ in SI, the second body mass $M_2 = 1000.0g$ in SI and the third body mass $M_3 = 1500.0g$ in SI by formulas (72), (73) and (74) according to the doubtful gravitation theory of Newton in the right side of equation $G \times \frac{M_1 \times M_2}{R_{1-2}^2} = \frac{M_2 \times V_2^2}{R_{1-2}}$

aren't confirmed experimentally with the help of dynamometer, then it means inaccuracy of the same so-called masses in the left side of the equation doubtful Newton gravitation law and Newton gravitation theory. It means that the validity of the doubtful Newtonian gravitation law and doubtful Newtonian gravitation theory isn't confirmed either theoretically or experimentally.

If the centrifugal force of the first body $F_{1-1} = 2509.98 \frac{gcm}{s^2}$, the centrifugal force of the second body $F_{1-2} = 3260.79 \frac{gcm}{s^2}$ and that of the third body $F_{1-3} = 6038.647 \frac{gcm}{s^2}$, that were determined with the help of the first body mass $M_1 = 1.0197g$ in TGT, the second body mass $M_2 = 1.0197g$ in TGT and the third body mass $M_3 = 1.5296g$ in TGT by the formulas (72), (73) and (74), according to TGT in the right side of the equation (23) are confirmed experimentally with help of dynamometer then it means the validity of the same masses in the left side of the equation (23) (Tsiganok gravitation law). It means that the validity of Tsiganok gravitation law as well as TGT are confirmed both theoretically and experimentally.

Practical usage of the formula (4) was impossible due to the lack of the methods of finding the second body mass M_2 since 1659. Practical usage of the formula (4) has become possible only after determining the second body mass M_2 with the help of formulas (1), (2) and (3) in the result of the creation of TGT since 2005.

The second law of motion must be formulated in the form of the formula (4) according to TGT. In contradistinction to the known formula, the second law of motion according to the formula (4) will work on the surface of stars, planets, planetary satellites with are longer or shorter radii than the Earth radius.

The results of our calculations showed that all the bodies in the Universe have weight and mass simultaneously, they also have them in the state of weightlessness. Body weight can be obtained with the help of a dynamometer or scales or by formulas. The body weight characterizes material bodies. It is possible to touch a material body with hands. It is possible to define the density (specific gravity) of a material body measured in $\frac{g}{cm^3}$. Body mass can't be defined with the help of a dynamometer or scales, but only with the help of formulas. Body mass characterizes non-material (virtual) bodies. It is impossible to touch a non-material body with hands. It is impossible to define the density (specific gravity) of a non-material body measured in $\frac{g}{cm^3}$.

The definition of body density (specific gravity) by the formula (12) showed that the known formula of Archimedes' principle doesn't correspond to reality. The repulsive force that acts on a body immersed in a liquid or a gas may be defined by the formulas (1), (2), (3), (4)

and (7) according to TGT on the surface of stars, planets, planetary satellites, etc. and in weightlessness.

Physical nature and the method of determining the law of bodies floating in liquids and gases (Archimedes' principle) will be shown later in another work.

The solution of the equation (23) showed that the so-called gravitational mass and inertial mass don't exist in reality (they are one and the same mass). It means, that all the known experiments for checking the so-called equivalence principle using lead balls, pendulums, torsion balance, hammers, bird feathers, lifts, atomic interferometers, etc. were not necessary [24].

The reason of the so-called Pioneer anomaly is the fact that the Sun, Jupiter, Saturn, etc. gravity acceleration is $g_{sun} = 3.265 \times 10^8 \frac{cm}{s^2}$, $g_{jup} = 3.113 \times 10^5 \frac{cm}{s^2}$, $g_{sat} = 9.342 \times 10^4 \frac{cm}{s^2}$, etc. according to TGT, but not $g_{sun} = 2.738 \times 10^4 \frac{cm}{s^2}$, $g_{jup} = 2.479 \times 10^3 \frac{cm}{s^2}$, $g_{sat} = 1.044 \times 10^3 \frac{cm}{s^2}$, etc. according to the doubtful Newtonian gravitation theory. It is also necessary to take into account that weight, mass, engine thrust and some other Pioneer 10/11 parameters aren't measured correctly according to the doubtful Newtonian gravitation theory.

Theoretical and experimental refutation of the existence of other so-called anomalies: dark matter, dark energy, perihelion precession of Mercury, etc. will be shown in some other work.

The law of electrostatics must be expressed in the form of (1), (2) and (3) formulas. It is known that the doubtful Coulomb's law was recognized because it was based the doubtful Newtonian gravitation law.

Physical nature and the method of definition of electrostatics law will be shown in another work.

The definition of body mass by the formula (8) and by other formulas of TGT showed that the so-called atomic weight, standard atomic weight, relative atomic mass, unified atomic mass unit, mass excess, atomic number, etc. don't correspond to reality. After finishing the work of the International Avogadro Coordination consortium of a new international standard-copy of the so-called kilogram 1.0 kg in SI [25] it will be possible to define weight, mass, gravity acceleration, average density (specific gravity) and other parameters of atoms. This new standard-copy of the so-called kilogram 1.0 kg in SI will be equated to a certain quantity of silicon 28Si atoms. After the quantity of atoms of silicon 28Si in the new standard-copy of the so-called kilogram 1.0 kg in SI is obtained it will be possible to find its weight, mass, gravity acceleration and other parameters. The weight of a silicon 28Si atom will be equal to the relation the new standard-copy weight $P_{sta} = 1000.0 \frac{gcm}{s^2}$ in TGT to the quantity of silicon 28Si atoms in it.

The mass of a silicon 28Si atom can be found by the formula (8) or by the formulas of physical and astrophysical constants according to the TGT that will be shown in another work. The gravity acceleration of silicon 28Si atom can be found by the formulas (10), (11) or by the formulas of physical and astrophysical constants according to TGT shown in another work. The average density (specific gravity) of silicon 28Si atom can be found with the help of the formulas (12). The force of gravitation between silicon 28Si atoms can be found with the help of the formulas (1), (2) and (3), etc.

In the same way it will be possible to find the weight, mass, gravity

acceleration, average density (specific gravity) and other parameters of atomic nuclei, electrons, protons, neutrons, etc. the so-called elementary particle.

After defining the parameters of all the atoms it will be possible to determine weight, mass, etc. of a chemical elements to formulate the periodic law, to complete the periodic table and to create chemistry as a science.

The results of our research make it possible for us to say that after the elaboration of TGT there have been created all the conditions to unite all the interactions and to formulate the so-called unified field theory (UFT) and to create physics as a science.

The results of our research confirmed the high professionalism of Christian Huygens and its lack as far as Newton, Cavendish, Einstein, etc. are concerned.

Conclusions

The investigations that were carried out showed that:

- Tsiganok gravitation law was discovered, TGT and its mathematical apparatus was elaborated;
- the definitions of body weight and body mass were given;
- the weight and masses of the Earth, the Sun, the Moon, etc. were defined;

gravity acceleration constant of 1.0g body was determined;

the gravity accelerations of the Earth, the Sun, the Moon etc. were found;

the gravitational constant was found;

temporary standard-copy of body weight ($P_{sta} = 1000.0 \frac{gcm}{s^2}$ in TGT) and temporary standard-copy of body mass ($M_{sta} = 1.0197g$ in TGT) for Tsiganok measurement system were elaborated;

- the measurement of density (specific gravity) in $\frac{g}{cm^3}$ wasn't confirmed either theoretically or experimentally (it was defined that density (specific gravity) is measured in $\frac{g}{cm^2s^2}$);

- average density (specific gravity) of the Earth, the Sun, the Moon, etc. was defined;

- weight, mass, gravity acceleration, density (specific gravity) and other parameters of bodies in various points of the Universe were found;

- the existence of weight of the Earth, the Sun, the Moon etc. in the state of weightlessness was confirmed both theoretically and experimentally;

- the existence of the so-called gravitational and inertial masses wasn't proved either theoretically or experimentally (they are one and the same mass);

- the Earth, the Moon, etc. centrifugal forces were found;
- the validity of centrifugal force formula was confirmed theoretically and experimentally;

- the force of gravitation between the Sun and the Earth, the Earth and the Moon was found;

- the second law formula of motion was made more precise;

- the existence of the so-called Pioneer anomaly was proved neither theoretically and experimentally;

- the pre-requisites for definition of weight, mass, gravity acceleration, density (specific gravity) and other parameters of atoms, atomic nuclei, electrons, protons, neutrons, the so-called elementary particles, etc. were created;

- the validity of the formula of the doubtful Newtonian gravitation law, of the doubtful Newtonian gravitation theory and its mathematical apparatus were proved neither theoretically nor experimentally;

- the validity of the formula of TGT and its mathematical apparatus was proved neither theoretically and experimentally.

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