Measuring the main physical and astrophysical constants and other bodies parameters

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The definitions of the main physical and astrophysical constants as well as formulas for their calculation have been given. Some formulas that make possible to find different body parameters have been presented.

Keywords: body, mass, gravity, distance, velocity, gravitation, field, constant.

I. INTRODUCTION

At present physical and astrophysical constants are of great importance for modern physics due to the lack of their theoretical grounds. This is confirmed by the fact that there is no definition of such a notion as "physical constant". Some specialists say that the majority of the known physical constants is in no way related to the true basic constants.

B.Rassel asserted that the criterion of basic constants is their irreducibility to each other: "It is usually (but not always) considered that none of them can be deduced from the others." No difference is made in using the notions "physical", "universal", "basic", "world" and astrophysical constants. At present numerical values of physical constants are obtained experimentally and haven't been explained in any theory yet. Many specialists are quite right considering the problem of physical constants to be the most important question of modern physics. The very existence of physical science becomes problematic without solving the given problem.

II. THE STATEMENT OF THE PROBLEM

It is considered that the sense of gravitation constant, which was obtained by H. Cavendish, is the gravitation between the first body with mass of $1g$ and the second body with the same mass that are placed at the distance of 1 cm between them. However, the dimension of Cavendish gravitation constant ($G = 6.6745 \times 10^{-8}\ cm^3g^{-1}s^{-2}$) doesn't coincide with force dimension. At the same time the relation of mass products of the bodies being attracted to the squared distance between them in Newton law doesn't make possible to obtain force dimension. To obtain force dimension in Newton law H. Cavendish introduced dimension cm^2g^{-2} additionally to gravitation constant. Force dimension $gcms^{-2}$ in Newton gravitation formula wouldn't arouse any doubts, if it included gravity with dimension cms^{-2}.

Nowadays, the point of view according to which H. Cavendish obtained the value of gravitation constant in the course of the well-known experiment with torsional scales is universally recognized. For this purpose he had to find the elastic force of thread torsion. However, this thread was too thin and not strong enough for direct measurements with the help of dynamometer, for example. That's why H.Cavendish elaborated a formula of thread torsion law that took into account the period of simple harmonic oscillations of a plank (lath) with small metallic balls suspended on it, as well as its mass and dimensions.

III. RESULTS

It was established in the process of research that mass, gravity, distance, velocity, gravitation and other parameters of bodies turned out to be closely connected with the main physical and astrophysical constants.

The acceleration due to gravity of $1g$ of a body, gravitation constant, constant, of gravitational field of a body and other main physical and astrophysical constants have been found with the help of different bodies parameters and vice versa.

The acceleration of gravity of $1g$ of a body, g_1^M - is the acceleration of gravity $2.5645 \times 10^{-22}cms^{-2}$, of a body with the mass of $1g$ equal to $2.5645 \times 10^{-22}cmg^{-1}s^{-2}$, expressed in $cmg^{-1}s^{-2}$.

The acceleration of gravity of $1g$ of a body g_1^M - is the relation of the acceleration of gravity of body g to body mass M, that is equal to $2.5645 \times 10^{-22}cmg^{-1}s^{-2}$, expressed in $cmg^{-1}s^{-2}$.

The acceleration of gravity of $1g$ of a body, g_1^M, has been obtained by the following formula

$$g_1^M = \frac{g}{M}, \tag{1}$$

where g_1^M is acceleration of gravity of $1g$ of a body, $cmg^{-1}s^{-2}$;
g is acceleration of gravity of a body, cms^{-1};
M is mass of a body, g.

The acceleration of gravity of $1g$ of a body g_1^M is the relation of gravitation field of $1g$ of a body, V_1^M to the doubled gravitation constant G, equal to $2.5645 \times 10^{-22}\ cmg^{-1}s^{-2}$, expressed in $cmg^{-1}s^{-2}$.

The acceleration of gravity of $1g$ of a body, g_1^M, was found with the help of the formula

$$g_1^M = \frac{V_1^M}{2G}, \tag{2}$$

where g_1^M is acceleration of gravity of $1g$ of a body, $cmg^{-1}s^{-2}$;
V_1^M is gravitation field constant of $1g$ of a body, $cm^3g^{-1}s^{-2}$;
G is gravitation constant, cm^2.

A gravitation field constant of a body, V_B^M - is the product of average distance from the first body to the second one R_{1-2} by the squared average orbital velocity of the second body V_2^2, expressed in cm^3s^{-2}.

A gravitation field constant of a body, V_B^M - is the characteristics of gravitation field of the first body with mass M_1 around which at the average distance from $R_{1-2} = 1cm$, to $R_{1-2} = V_B^M cm$, where $V_2^2 = 1cm^2s^{-2}$, there rotates the second body with mass M_2 at the average orbital velocity from $V_2^2 = V_B^M cm^2s^{-2}$, where $R_{1-2} = 1cm$ to $V_2^2 = 1cm^2s^{-2}$ expressed in cm^3s^{-2}.

The constant of gravitation field of body V_B^M was found by the formula

$$V_B^M = R_{1-2}V_2^2, \tag{3}$$

where V_B^M is the body gravitation field constant, cm^3s^{-2};
R_{1-2} is the distance between the first and the second bodies, cm;
V_2 is the average orbital velocity of the second body, cms^{-1}.

The value V_B^M is connected with Virial theorem that characterizes the relationship between the average value of summarized kinetic energy of the system of bodies moving in a limited area of space and the forces acting within it stated (established) by R. Clausius in 1870.

The constant of gravitation field of $1g$ of a body, V_1^M is the doubled product of gravitation constant G and acceleration of gravity of $1g$ of a body, g_1^M, equal to 1.0432386×10^{-4} $cm^3g^{-1}s^{-2}$, expressed in $cm^3g^{-1}s^{-2}$.

The constant of gravitation field of $1g$ of a body V_1^M is the characteristics of gravitation field of the first body with the mass $M_1 = 1g$ round which at the average distance from $R_{1-2} = 1.0432386 \times 10^{-4}$ cm to $R_{1-2} = 1$ cm there rotates the second body with the mass M_2 and average velocity from $V_2^2 = 1$ cm^2s^{-2} to $V_2^2 = 1.0432386 \times 10^{-4}$ cm^2s^{-2}, equal to 1.0432386×10^{-4} $cm^3g^{-1}s^{-2}$, expressed in $cm^3g^{-1}s^{-2}$.

The constant of gravitation field of $1g$ of a body was obtained by the formula

$$V_1^M = 2Gg_1^M, \tag{4}$$

where V_1^M is the constant of gravitation field of $1g$ of a body, $cm^3g^{-1}s^{-2}$;
G is the gravitation constant cm^2;
g_1^M is acceleration of gravity of $1g$ of a body, $cmg^{-1}s^{-2}$.

The constant of gravitation field of $1g$ of a body, V_1^M is the relation of the constant of gravitation field of a body V_B^M to the first body mass M_1, equal to 1.0432386×10^{-4} $cm^3g^{-1}s^{-2}$, expressed in $cm^3g^{-1}s^{-2}$.

The constant of gravitation field of $1g$ of a body, V_1^M was obtained by the formula

$$V_1^M = \frac{V_B^M}{M_1}, \tag{5}$$

where V_1^M is the constant of gravitation field of $1g$ of a body, $cm^3g^{-1}s^{-2}$;
V_B^M is the constant of gravitation field of a body, cm^3s^{-2};
M_1 is the first body mass, g.

The constant of gravitation field of a body V_B^M is the product of gravitation constant G, the first body mass M_1 and the acceleration of gravity of $1g$ of a body, expressed in cm^3s^{-2}.

The constant of gravitation field of a body V_B^M was found by the formula

$$V_B^M = 2GM_1g_1^M, \tag{6}$$

where V_B^M is the constant of gravitation field of a body, cm^3s^{-2};
G is the gravitation constant, cm^2;
M_1 is the first body mass, g;
g_1^M is the acceleration of gravity of $1g$ of a body, $cmg^{-1}s^{-2}$.

The constant of gravitation field of a body, V_B^M is the product of the constant of gravitation field of $1g$ of a body, V_1^M by the first body mass M_1, expressed in $cm^3g^{-1}s^{-2}$.

The constant of gravitation field of a body, V_B^M was obtained by the formula

$$V_B^M = V_1^M M_1, \tag{7}$$

where V_B^M is the constant of gravitation field of a body, cm^3s^{-2};
V_1^M is the constant of gravitation field of $1g$ of a body, $cm^3g^{-1}s^{-2}$;
M_1 is the first body mass, g.

The constant of gravitation field of a body, V_B^M is the relation of the first body mass M_1, and the constant of gravitation field $1cm^3s^{-2}$ of a body, V_1^V, expressed in cm^3s^{-2}.

The constant of gravitation field of a body, V_B^M was found by the formula

$$V_B^M = \frac{M_1}{V_1^V}, \tag{8}$$

where V_B^M is the constant of gravitation field of a body, cm^3s^{-2};
M_1 is the first body mass, g;
V_1^V is the constant of gravitation field of $1g$ of a body, $1cm^3s^{-2}$ of a body, gs^2cm^{-3}.

The of gravitation constant G is the area of gravitation field of a body with mass $M = 1.9497 \times 10^{21}g$ and with acceleration of gravity $g = 0.5$ cms^{-2} equal to $2.034 \times 10^{17}cm^2$.

The of gravitation constant G is the relation of the constant of gravitation field of $1g$ of a body, V_1^M to the doubled acceleration of gravity of $1g$ of a body g_1^M, equal to $2.034 \times 10^{17}cm^2$, expressed in cm^2.

The gravitation constant G was obtained by the formula

$$G = \frac{V_1^M}{2g_1^M}, \tag{9}$$

where G is the gravitation constant cm^2;
V_1^M is the constant of gravitation field of $1g$ of a body, $cm^3g^{-1}s^{-2}$;
g_1^M is the acceleration of gravity $1g$ body, $cmg^{-1}s^{-2}$.

The gravitation constant G was found by the formula

$$G = \frac{V_1^M g_B^M}{2}, \tag{10}$$

where G is gravitation constant, cm^2;
V_1^M is the constant of gravitation field of a body, $cm^3g^{-1}s^{-2}$;
g_B^M is the constant of 1 cms^{-2} of acceleration of gravity a body, $gs^{-2}cm^{-1}$.

The gravitation constant G - is the value that is universe to the product of the doubled constant of 1 cm^3s^{-2} of a body gravitation field by the acceleration of gravity of $1g$ of a body equal to $2.034 \times 10^{17} cm^2$, expressed in cm^2.

The gravitation constant G was found by the formula

$$G = \frac{1}{2V_1^V g_1^M}, \tag{11}$$

where G is gravitation constant, cm^2;
V_1^V is the constant of 1 cm^3s^{-2} of gravitation field of a body, gs^2cm^{-3};
g_1^M is the acceleration of gravity of $1g$ of a body, $cmg^{-1}s^{-2}$.

The constant of gravitation field of 1 cm^3s^{-2} of a body, V_1^V is the relation of the first body mass M_1 to the constant of gravitation field of a body, V_B^M equal to 9585.5349 gs^2cm^{-3}, expressed in gs^2cm^{-3}.

The constant of gravitation field of 1 cm^3s^{-2} of a body V_1^V was found by the formula

$$V_1^V = \frac{M_1}{V_B^M}, \tag{12}$$

where V_1^V is the constant of gravitation field of 1 cm^3s^{-2} of a body, gs^2cm^{-3};
M_1 is the first body mass, g;
V_B^V is the constant of gravitation field of a body, cm^3s^{-2}.

The constant of gravitation field of 1 cm^3s^{-2} of a body, V_1^V is the body mass 9585.5349 g generating the gravitation field with the constant of gravitation field of a body $V_B^V = 1$ cm^3s^{-2}, equal to 9585.5349 gs^2cm^{-3}, expressed in gs^2cm^{-3}.

The constant of gravitation field of 1 cm^3s^{-2} of a body, V_1^V was obtained by the formula

$$V_1^V = \frac{1}{V_1^M}, \tag{13}$$

where V_1^V is the constant of gravitation field of 1 cm^3s^{-2} of a body, gs^2cm^{-3};
V_1^M is the constant of gravitation field of $1g$ of a body, $cm^3g^{-1}s^{-2}$.

The constant of 1 cms^{-2}, of acceleration of gravity of a body, g_B^M is the first body mass $3.8994 \times 10^{21} g$, having acceleration of gravity of 1 cms^{-2}, equal to $3.8994 \times 10^{21} gs^2cm^{-1}$, expressed in gs^2cm^{-1}.

The constant of 1 cms^{-2}, of acceleration of gravity of a body, g_B^M was obtained by the formula

$$g_B^M = \frac{M_1}{g_1}, \tag{14}$$

where g_B^M is the constant of 1 cms^{-2} of acceleration of gravity of a body, gs^2cm^{-1};
M_1 is the first body mass, g;
g_1 is the first body acceleration of gravity, cms^{-2}.

Gravitational radius of a body, R_{BR} is the relation of gravitation field constant of a body, V_B^M to the squared light velocity, c^2, expressed in cm.

Gravitational radius of a body, R_{BR} was found from the formula

$$R_{BR} = \frac{V_B^M}{c^2}, \tag{15}$$

where R_{BR} is gravitational radius of a body, cm;
V_B^M is gravitation field constant of a body, cm^3s^{-2};
c is light velocity, cms^{-1}.

The new theory is based on the gravitation formula the deduction of which will be presented in some other work [1].

$$F_{1-2} = \sqrt{G}\frac{\sqrt{G}\frac{M_1 g_2}{R_{1-2}} + \sqrt{G}\frac{M_2 g_1}{R_{1-2}}}{R_{1-2}} = G\frac{M_1 g_2 + M_2 g_1}{R_{1-2}^2}, \tag{16}$$

where F_{1-2} is gravitation force between the first and the second bodies, $gcms^{-2}$;
G is gravitation 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 acceleration of gravity, cms^{-2};
g_2 is the second body acceleration of gravity, cms^{-2};
R_{1-2} is the distance between the first and the second bodies, cm.

The gravitation force between two bodies F_{1-2} is directly proportional to the sum of two forces, that is, the force of gravitation of the first body to the second $\sqrt{G}\frac{M_1 g_2}{R_{1-2}}$ and the force of gravitation of the second body to the first $\sqrt{G}\frac{M_2 g_1}{R_{1-2}}$ and inversely proportional to the distance between these bodies, R_{1-2}.

The gravitation force between the bodies, obtained with the help of the new formula is quite different from the force in Newton formula:

- the new formula gives force dimension without taking into account the gravitation constant;
- the masses of the bodies being attracted are not multiplied by each other; they are multiplied by the corresponding acceleration of gravity and only after that they are summed up;
- the gravitation constant includes only those values, that are contained in the new gravitation formula.

In order to find the gravitation force between different bodies as well as other parameters, the gravitation force, F_{1-2}, found by the formula (16) was equated to centrifugal force

$$G\frac{M_1 g_2 + M_2 g_1}{R_{1-2}} = \frac{M_2 V_2^2}{R_{1-2}}. \quad (17)$$

Taking into account that $g = M g_1^M$ the equation (17) was written as follows

$$G\frac{M_1 M_2 g_1^M + M_2 M_1 g_1^M}{R_{1-2}^2} = \frac{M_2 V_2^2}{R_{1-2}}. \quad (18)$$

The left and the right parts of equality (18) were presented as the product of two factors: $\frac{M_2}{R_{1-2}}$ and other members of the equality

$$\frac{M_2}{R_{1-2}}\left(\frac{2GM_1 g_1^M}{R_{1-2}}\right) = \frac{M_2}{R_{1-2}} V_2^2. \quad (19)$$

Due to the fact that the relations of $\frac{M_2}{R_{1-2}}$ in the left and in the right parts of equality (19) are the same, the other elements in both parts of the equality must be also equal.

Taking into account that $M_1 g_2 = M_2 g_1$ the left and the right parts of equality (16) were written down as the sum of two addenda

$$\frac{GM_1 g_2}{R_{1-2}^2} + \frac{GM_2 g_1}{R_{1-2}^2} = \frac{M_2 V_2^2}{2R_{1-2}} + \frac{M_2 V_2^2}{2R_{1-2}}. \quad (20)$$

Taking into account that the addenda in the right part of equality (20) are equal we state that those in the left part are also equal.

The first addendum in the left part of equality (20) was equated to one of the addenda in the right part (20)

$$\frac{GM_1 g_2}{R_{1-2}^2} = \frac{M_2 V_2^2}{2R_{1-2}}. \quad (21)$$

The second addendum in the left part of equality (20) was equated to one of the addenda in the right part of this equality (20)

$$\frac{GM_2 g_1}{R_{1-2}^2} = \frac{M_2 V_2^2}{2R_{1-2}}. \quad (22)$$

Having in mind that $M_1 g_2 = M_2 g_1$, the formula (16) was written down in such a form

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

If $g = M g_1^M$, the formula (23) is the following

$$M_1 M_2 g_1^M = M_2 M_1 g_1^M. \quad (24)$$

The parameters in the left and in the right parts of the equality (23) turned out to be the same.

The equalities (17), (19), (21) and (22) made possible some new formulas for finding parameters of different bodies. For this purpose equalities (17), (19), (21), and (22) must be solved with regard to all the parameters included.

Having reduced the relation of $\frac{M_2}{R_{1-2}}$ in the left and in the right parts of equality (19) we have obtained the gravitation formula

$$V_2^2 = \frac{2GM_1 g_1^M}{R_{1-2}}. \quad (25)$$

Having solved formula (19) with regard to $R_{1-2}V_2^2$ we found

$$R_{1-2}V_2^2 = 2GM_1 g_1^M. \quad (26)$$

It follows from equation (26) that its left and right parts are constant values.

Taking into account that $V_B^M = R_{1-2}V_2^2$ and $V_1^M = 2Gg_1^M$ one can write down formula (25) as follows

$$V_B^M = V_1^M M_1. \quad (7)$$

On solving equation (21) with regard to $R_{1-2}V_2^2$ we obtain

$$R_{1-2}V_2^2 = \frac{2GM_1 g_2}{M_2}. \quad (27)$$

For $V_B^M = R_{1-2}V_2^2$, $g_1^M = \frac{g_2}{M_2}$ and $V_1^M = 2Gg_1^M$ formula (27) may be written down in such a way

$$V_B^M = V_1^M M_1. \quad (7)$$

If $V_B^M = R_{1-2}V_2^2$, $V_1^M = 2Gg_1^M$ and $V_1^V = \frac{1}{V_1^M}$ formula (25) is as follows

$$V_B^M = \frac{M_1}{V_1^V}. \quad (28)$$

Having solved formula (22) with regard to $R_{1-2}V_2^2$ we obtain

$$R_{1-2}V_2^2 = 2Gg_1. \quad (29)$$

Taking into account that $V_B^M = R_{1-2}V_2^2$ we write down formula (22) in such form

$$V_B^M = 2Gg_1. \quad (30)$$

Having solved formula (25) with regard to G we obtain

$$G = \frac{R_{1-2}V_2^2}{2M_1 g_1^M}. \quad (31)$$

Taking into account that $V_B^M = R_{1-2}V_2^2$ and $g_1 = M_1 g_1^M$ we can obtain formula (25) and write down the following

$$G = \frac{V_B^M}{2g_1}. \tag{32}$$

We solved equation (22) with regard to G and found

$$G = \frac{R_{1-2}V_2^2}{2g_1}. \tag{33}$$

Taking into account that $V_B^M = R_{1-2}V_2^2$ formula (33) is written down as follows

$$G = \frac{V_B^M}{2g_1}. \tag{34}$$

Solving equation (21) with regard to G we obtain

$$G = \frac{R_{1-2}V_2^2 M_2}{2M_1 g_2}. \tag{35}$$

If $V_B^M = R_{1-2}\ V_2^2$, $V_1^M = \dfrac{V_B^M}{M_1}$ and $g_B^M = \dfrac{M_2}{g_2}$, then formula (35) may be written down in such a form

$$G = \frac{V_1^M g_B^M}{2}. \tag{10}$$

If we solve formula (25) with regard to M_1, we obtain

$$M_1 = \frac{R_{1-2}V_2^2}{2Gg_1^M}. \tag{36}$$

The mass of a body M is the relationship between gravitation field constant of a body V_B^M and gravitation field constant of $1g$ of a body, V_1^M, expressed in g.

Taking into account that $V_B^M = R_{1-2}V_2^2$, and $V_1^M = 2Gg_1^M$ we can write down formula (36) in such a way

$$M_1 = \frac{V_B^M}{V_1^M}. \tag{37}$$

Taking into account that $V_1^V = \dfrac{1}{V_1^M}$, we'll write formula (25) as follows

$$M_1 = V_B^M V_1^V. \tag{38}$$

Having solved equation (21) with regard M_1 we obtain

$$M_1 = \frac{R_{1-2}V_2^2 M_2}{2Gg_2}. \tag{39}$$

If $V_B^M = R_{1-2}V_2^2$ and $g_B^M = \dfrac{M_2}{g_2}$ formula (39) was written down in such a form

$$M_1 = \frac{V_B^M g_B^M}{2G}. \tag{40}$$

Having solved equation (21) with regard to M_2 we obtain

$$M_2 = \frac{2GM_1 g_2}{R_{1-2}V_2^2}. \tag{41}$$

If $V_B^M = R_{1-2}V_2^2$, $V_1^V = \dfrac{M_1}{V_B^M}$ and $g_B^M = 2GV_1^V$ then formula (41) may be written down as follows

$$M_2 = g_B^M g_2. \tag{42}$$

Equality (23) helped to get new formulas to find the masses of different bodies

$$M_1 = \frac{M_2 g_1}{g_2}; \tag{43}$$

$$M_2 = \frac{M_1 g_2}{g_1}. \tag{44}$$

Having solved equation (21) with regard to g_2 we obtained

$$g_2 = \frac{R_{1-2}V_2^2 M_2}{2GM_1}. \tag{45}$$

If $V_B^M = R_{1-2}V_2^2$, $V_1^M = \dfrac{V_B^M}{M_1}$ and $g_1^M = \dfrac{V_1^M}{2G}$ we can write down formula (45) in such a way

$$g_2 = M_2 g_1^M. \tag{46}$$

Having solved equation (22) with regard to g_1, we obtained

$$g_1 = \frac{R_{1-2}V_2^2}{2G}. \tag{47}$$

If $V_B^M = R_{1-2}V_2^2$, formula (47) was written down in such a way

$$g_1 = \frac{V_B^M}{2G}. \tag{48}$$

Due to equality (23) it was possible to receive new formulas for obtaining acceleration of gravity of different bodies

$$g_1 = \frac{M_1 g_2}{M_2}; \tag{49}$$

$$g_2 = \frac{M_2 g_1}{M_1}. \tag{50}$$

Taking into account that $V_1^M = 2Gg_1^M$ and $V_B^M = V_1^M M_1$ we can write down formula (25) as follows

$$V_2 = \sqrt{\frac{V_B^M}{R_{1-2}}}, \tag{51}$$

where V_2 is the average orbital velocity of the second body, cms^{-1}.

Having solved equation (21) with regard to V_2^2 we obtain

$$V_2^2 = \frac{2GM_1 g_2}{R_{1-2} M_2}. \quad (52)$$

Having solved formula (25) with regard to R_{1-2} we obtain

$$R_{1-2} = \frac{2GM_1 g_1^M}{V_2^2}. \quad (53)$$

Taking into account, that $V_1^M = 2Gg_1^M$ and $V_B^M = V_1^M M_1$ formula (53) may be written down as follows

$$R_{1-2} = \frac{V_B^M}{V_2^2}. \quad (54)$$

Having solved equation (21) with regard to R_{1-2} we obtain

$$R_{1-2} = \frac{2GM_1 g_2}{V_2^2 M_2}. \quad (55)$$

Taking into account that $g_1^M = \frac{g_2}{M_2}$, $V_1^M = 2Gg_1^M$ and $V_B^M = V_1^M M_1$ we write down formula (55) in the following way

$$R_{1-2} = \frac{V_B^M}{V_2^2}. \quad (54)$$

Having solved equation (22) with regard to R_{1-2} we obtain

$$R_{1-2} = \frac{2Gg_1}{V_2^2}. \quad (56)$$

IV. CONCLUSIONS

Having solved equalities (17), (19), (21) and (22) with regard to all parameters included into them, using as an example different bodies in the Solar system and galaxy the Milky Way, we became convinced in their validity.

V. LITERATURE

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