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Possibility of Refining the Gravitational Constant and Solving the Task of Integrating the Gravitational and Electromagnetic Fields

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Abstract

Currently gravitational constant G is defined up to 5 characters, that is 2 or 3 orders of magnitude less than the accuracy of other fundamental physical constants – the speed c of light in vacuum and Planck's constant h. However, in the Earth conditions the possibility of increasing the accuracy of defining G experimentally has reached its technical limit, which requires the search of new fundamental approaches. For this purpose, the original approach is suggested and the system of calculated dependences resulted from fundamental physical constants c, G, h, as well as from Planck's values of length l_p, time t_p and mass m_p, is obtained allowing to refine the presently known value of the gravitational constant G by 3 orders. At this, the necessity of experimental determination of G is eliminated, it is only enough to define c and h, and the increase in their accuracy will automatically lead to the increase in the accuracy of refining G value. On this basis, the frequency of the gravitational field is singled out, which made it possible to obtain its other wave parameters and solve the problem of integrating the gravitational and electromagnetic fields at the strict physical and mathematical level.

Keywords: Gravitational constant; Integrating gravitation; Electromagnetic field

Introduction

The paper deals with quantum physics, astronomy, space physics, studying the laws of gravitation, the fundamentals of material world and the Universe parameters, as well as with solving the task of integrating the gravitational and electromagnetic fields.

The gravitational constant, *G* is a fundamental physical constant used for determining masses of the material world objects and their interaction at all levels from subatomic to mega level. The necessity of increasing its accuracy is stipulated by scientific interests in many spheres of applied and theoretical physics, at this, it is necessary to especially single out the determination of the trajectory of space objects flying up to the Earth, for which it is possible to more accurately determine the probability of a collision, space flights towards faraway objects for which the accuracy of calculating their orbits and trajectories of movement towards them increases. In addition, constant demands to increase the accuracy of G are stipulated by the increase of general requirements for the level of knowledge about the Universe and its fundamentals including the problem of integrating the gravitational and electromagnetic fields. It confirms the importance and relevance of the problem considered the solution of which is being given constant attention to in the scientific world.

Problem state analysis and task statement

The introduction of the gravitational constant *G* is connected with Newton's discovery of the law of Universal gravitation as early as in 1665, however its numerical value was not found at that time. According to the currently adopted definition of physical sense of the gravitational constant [1] it is a coefficient connecting within the law of Universal gravitation (1) numerically and by dimension the value of force of interaction *F*, between two pointwise objects with masses m_1, m_2 at the distance *r* between them:

$$F = G\frac{m_1 m_2}{r^2}(N) \quad (1)$$

In 1798 Cavendish by direct experiment found out mutual attraction of two objects in experiments made by means of torsion balance and for the first time he could define the numerical value of the gravitational constant *G* included into Newton's law which in the SI system made up a value of $G = 6.62\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right)$, and afterwards this value was constantly refined [2]. Especially important were the experiments by Jolly in 1881 $G = 6.67\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right)$, however until 1969 i.e., 170 years after the first experiments, its accuracy did not exceed 3 characters $G = 6.668(5)\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right)$ [2]. By 1980 its accuracy had increased only by 1 character [3], by 1986 – by one more character [1], and by 2000 –by another one more character (2) [4]:

$$G = 6.67390(13)\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right). \quad (2)$$

Further, CODATA recommended new values of G, which strongly differed from each other (5…7), which significantly confused the situation with its real value. At the same time, the complexity of the technical systems created for experimental studies of G has grown. However, currently 2014, its accuracy does not actually exceed 5 characters (3), while the accuracy of other fundamental physical constants - the velocity of light in vacuum c (4) and Planck's constant *h* (5) is currently 9 characters [4,5]:

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$$G = 6.67408(31)\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right). \quad (3)$$

c - The velocity of light in vacuum:

$$c = 0.299792458\times10^{9}\frac{m}{s} \quad (4)$$

h – Planck's constant:

$$h = 6.626070040(81)\times10^{-34}\,J\times s \quad (5)$$

Thus, the task of increasing the accuracy of the constant *G* is important and relevant for many spheres of life and activity of man and society as a whole, not only cognitive, but also practical, which determines the need for work on its early resolution, the urgency of which has increased dramatically in recent years in the field of space and nuclear research. Therefore, solving the problem of increasing the accuracy of determining the gravitational constant *G* is the first goal of the work performed. Its second goal is to solve the problem of integrating the gravitational and electromagnetic fields on the basis of a new representation of the gravitational constant. The rationale and solution of these problems is the scientific novelty of the work performed.

Justification of the need for a fundamentally new solution to the tasks stated

The lower accuracy of the gravitational constant in comparison with other fundamental physical constants is explained by the high complexity of its experimental determination. This is due to the force interaction between the masses under the conditions of the third object's existence - the Earth, incl. the walls of the room in which experiments are conducted and the objects surrounding it. To assess them, the law of Universal gravitation (1) is adopted as original, which allows to determine the influence of masses m_1, m_2 and distances r between them on the force value *F*.

When the forces F are equal, one can estimate the influence on the accuracy of the determination of *G* of the neighboring masses and the distances between them. For this purpose, the system of *G* measurements on the torsion balance is adopted as the initial with the baseball of the mass of 1 ton (1000 kg) and with a small ball weighing 1 g (0.001 kg) applied at a distance of 0.3 m to its center. This ratio of masses (1,000,000/1) is chosen because, according to the law of the Universal gravitation, the small ball also attracts the large one, so it will influence the determination of the value of the gravitational constant, which in this ratio will appear only after the sixth character of the accuracy of *G*. To reduce the size of the balls their density should be maximum, the preferred material is lead. In further calculations, we consider the system of interaction of balls to be ideal, and the mass of the balls concentrated in their centers, since deviations from real parameters will not unduly influence the general nature of the studies conducted at this stage, which have only estimating nature and will be of the same order. Further, the error of such an estimate can be taken into account by correction factors based on real research. Therefore, we assume that the value of *G* is the value of (3), and the gravitational force in this system amounts to:

$$F = G\frac{m_1 m_2}{r^2} = 6.67408\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right)\frac{1000(kg)\times0.001(kg)}{0.316^2(m)^2} = 7.41564\times10^{-10}(N) \quad (6)$$

On the opposite side of the small ball, we assume that masses of different sizes are located at different distances from it, within the mass matrix and the dimensions shown in Table 1.

Neighboring masses (kg)	Distances (m) between interacting objects				
	1	10	100	1000	10000
	Gravitational forces *F* (N) acting on the objects				
1	7.4156×10^{-14}	7.4156×10^{-16}	7.4156×10^{-18}	7.4156×10^{-20}	7.4156×10^{-22}
10	7.4156×10^{-13}	7.4156×10^{-15}	7.4156×10^{-17}	7.4156×10^{-19}	7.4156×10^{-21}
100	7.4156×10^{-12}	7.4156×10^{-14}	7.4156×10^{-16}	7.4156×10^{-18}	7.4156×10^{-20}
1000	7.4156×10^{-11}	7.4156×10^{-13}	7.4156×10^{-15}	7.4156×10^{-17}	7.4156×10^{-19}
10000	7.4156×10^{-10}	7.4156×10^{-12}	7.4156×10^{-14}	7.4156×10^{-16}	7.4156×10^{-18}

Table 1: Opposite forces of gravitation *F*, acting on a small ball in the torsion balance system.

Neighboring masses (kg)	The order of accuracy of measurements of the gravitational constant *G*				
	5 characters	6 characters	7 characters	8 characters	9 characters
	Minimum distances to objects (m) that affect the order of the measurement accuracy of *G*				
1	3,2	10	32	100	320
10	10	32	100	320	1000
100	32	100	320	1000	3200
1000	100	320	1000	3200	10000
10000	320	1000	3200	10000	32000

Table 2: Opposite forces of gravitational constant *G*, acting on a small ball in the torsion balance system.

Gravitational forces $F \geq 7.4156\cdot10^{-16}$(N) – it's the very big parameter of this accuracy G. Thus, to increase the final accuracy of experiments conducted to determine the gravitational constant from its initial 6 to 9 characters, which have other fundamental physical constants *c* (4) and *h* (5), it is necessary to exclude the presence of the nearest masses within the distances shown in Table 2.

Consequently, the achievement of the accuracy of experimental measurements of *G* in 7 or more characters on torsion balance, at the present level of science and technology, is practically impossible in the real conditions of the Earth. A system with dynamic ball movement [4] can increase its accuracy within 1 character, for example, if it is suspended at a height of 32 m in an empty room of an inflatable load-bearing structure with a height of more than 32 m. As the complexity of such systems increases dramatically, and in the last 35 years the accuracy of the measurement has increased only to 5th character, then the desired increase in accuracy from 6 to 9 characters, or by 3 orders of magnitude, can be expected for unpredictably long time, as it requires the solution of problems of inventive level, the creation of which, or at least their real prediction, does not lend itself to strict laws.

Thus, it is relevant and important to search for fundamentally new approaches to refine the value of the gravitational constant *G*, which is the main task of the work performed [6-8].

New possibility of refinement of the gravitational constant and its proof

Three scientific discoveries are put in the basis of the solution of this problem:

1st discovery: The reality of Planck's values of length l_p, time t_p and mass m_p, proved in (8...10):

$$l_p = \sqrt{\frac{hG}{c^3}} = \sqrt{\frac{6.62607004\times10^{-34}(J\times s)\times6.67408\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right)}{\left[0.299792458\times10^{9}\left(\frac{m}{s}\right)\right]^3}} = 4.05128\times10^{-35}(m) \quad (7)$$

$$t_p = \sqrt{\frac{hG}{c^5}} = \sqrt{\frac{6.62607004\times10^{-34}\,(\mathrm{J\times s})\times 6.67408\times10^{-11}\left(\frac{\mathrm{m^3}}{\mathrm{kg\times s^2}}\right)}{\left[0.299792458\times10^{9}\left(\frac{\mathrm{m}}{\mathrm{s}}\right)\right]^5}} = 13.5136\times10^{-44}\,(\mathrm{s}) \quad (8)$$

$$m_p = \sqrt{\frac{hs}{G}} = \sqrt{\frac{6.62607004\times10^{-34}\,(\mathrm{J\times s})\times 0.299792458\times10^{9}\left(\frac{\mathrm{m}}{\mathrm{s}}\right)}{6.67408\times10^{-11}\left(\frac{\mathrm{m^3}}{\mathrm{kg\times s^2}}\right)}} = 5.45560\times10^{-8}\,(\mathrm{kg}) \quad (9)$$

Previously they were considered abstract values, since the electron mass me=9.1093897.10-31 kg [1], which is 23 orders of magnitude smaller than Planck's mass mp=5.45560.10-8 kg, and its classical radius re=2.8179409.10-15 m [1], which is 20 orders of magnitude greater than Planck's length lp=4.05128.10-35 m. Such a ratio contradicts the harmony of masses and dimensions in the material world and forces to consider all Planck's parameters mp, lp, tp obtained on the basis of the same constants c, G, h, and similar physical laws (6-8) abstract values that could characterize the state of the Universe only in the moment of its birth.

The indicated failing is removed in works [8,9]. Planck's mass mp was related to the layer spheres of the Planck's thickness lp of visible Universe (Figure 1):

2nd discovery: The possibility of expressing the fundamental physical constants in the framework of their dimension in terms of their Planck's values l_p, t_p, m_p found in the study of Nastasenko [10,11], which for the gravitational constant G amounts to (10):

$$G\left(\frac{\mathrm{m^3}}{\mathrm{kg\times s^2}}\right) = \frac{l_p^3}{m_p t_p^2} = \frac{\left[4.05128\times10^{-35}\,(\mathrm{m})\right]^3}{5.45560\times10^{-8}\,(\mathrm{kg})\times\left[13.5136\times10^{-44}\,(\mathrm{s})\right]^2} = 6.67409\times10^{-11}\left(\frac{\mathrm{m^3}}{\mathrm{kg\times s^2}}\right) \quad (10)$$

The expression for Planck's frequency (11) for a time period of 1 second (1 s) found in studies of Nastasenko and Byrdyn [12,13], which within the accuracy of Planck's time (8) can be an exact quantum number (12) – this 1st work hypnothesis.

$$\nu_p = \frac{1}{t_p} = \frac{1}{13.5136\times10^{-44}\,(\mathrm{s})} = 7.39994\times10^{42}\,(\mathrm{s^{-1}}) \quad (11)$$

$$1(\mathrm{s}) \rightarrow 7.4\cdot10^{42}\,t_p \quad (12)$$

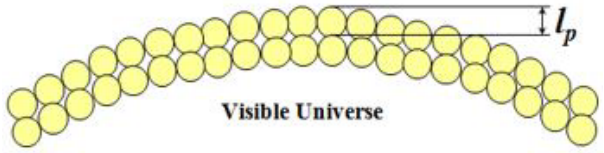

Figure 1: Layer of the plank's thickness of visible universe.

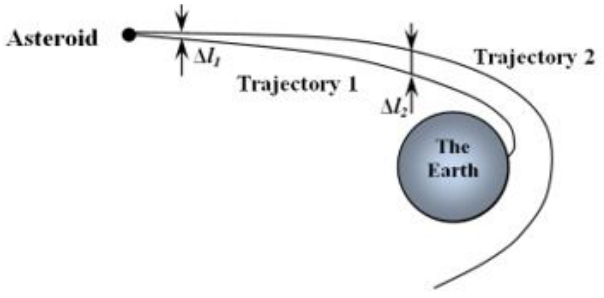

Figure 2: Parameters of changing the flight trajectory of asteroids dangerous for the earth.

Connection gravitational constant G with other fundamental physical constants c, h (13), which practically coincides with the initial one (8) [12]:

$$G = \frac{t_p^2 c^5}{h} = \frac{\left[13.5136\times10^{-44}\,(\mathrm{s})\right]^2\left[0.299792458\times10^{9}\left(\frac{\mathrm{m}}{\mathrm{s}}\right)\right]^5}{6.62607008\times10^{-34}\,(\mathrm{J\times s})} = 6.67405\times10^{-11}\left(\frac{\mathrm{m^3}}{\mathrm{kg\times s^2}}\right) \quad (13)$$

3rd discovery: The connection gravitational constant G with Planck's frequency ν_p [13]:

$$G = \frac{t_p^2 c^5}{h\ h} = \frac{c^5}{\nu_p^2} \quad (14)$$

Thus, with the exact value of $\nu_p = 7.4\cdot10^{42}(s^{-1})$, the gravitational constant, at the strict physical (14) and mathematical level [13,14], amounts the value with the accuracy of up to 9 characters (15):

$$G = \frac{c^5}{\nu_p^2 h} = \frac{\left[0.299792458\times10^{9}\left(\frac{\mathrm{m}}{\mathrm{s}}\right)\right]^5}{\left[7.4\times10^{42}\left(\mathrm{s^{-1}}\right)\right]^2 6.626070080\times10^{-34}\,(\mathrm{J\times s})} = 6.6739669698\times10^{-11}\left(\frac{\mathrm{m^3}}{\mathrm{kg}^{\ 2}}\right) \quad (15)$$

The possible periodicity of the fundamental physical constants found in https://www.nobelprize.org/nobel_prizes/physics/laureates/2017/press.html [15], which is manifested in the dependence of Planck's time t_p (16) with the exact value of ν_p (11) – this 2-th work hypnotize**:**

$$t_p = \frac{1}{\nu_p} = \frac{1}{7.4\times10^{42}(\mathrm{s^{-1}})} = 13.5135135...\times10^{-44}(\mathrm{s}) \quad (16)$$

Thus, with the periodicity of the Planck's time t_p (16) and gravitational constant G (15) amounts the value with the accuracy of up to 18 characters (17) [15] (further, a statistical error appears, since the physical laws within quantum physics and under the law of uncertainty are statistical):

$$G = 6.67396\,|\,69\,|...\times10^{-11}\left(\frac{\mathrm{m^3}}{\mathrm{kg\times s^2}}\right) \quad (17)$$

Further, it is necessary to prove the reliability of the obtained result (17). The best way is a direct experimental check in new measurements of G, which is very difficult because of the complexity of such studies. Therefore, the second and more realistic way is to use the new value of G in the calculation of the trajectories of space objects and their subsequent experimental verification. First of all, these are calculations of the trajectories of asteroids moving to the Earth. A more precise value of G will allow us to determine beforehand whether it will collide with the Earth or not, and at earlier stages of approach, the degree of action of Δl_1 for changing the trajectory of motion and the energy expended on it will be significantly less than Δl_2 at later stages of approach (Figure 2):

In this base is possible to determine a new Planck's constant h (18):

$$h = \frac{c^5}{\nu_p^2 G} = \frac{\left[0.299792458\times10^{9}\left(\frac{\mathrm{m}}{\mathrm{s}}\right)\right]^5}{\left[7.4\times10^{42}\left(\mathrm{s^{-1}}\right)\right]^2 6.67396\,|\,69\,|\times10^{-11}\left(\frac{\mathrm{m^3}}{\mathrm{kg\times s^2}}\right)} = 6.6260700401357\,15\times10^{-34}\,(\mathrm{J\times s}) \quad (18)$$

After accurate value of gravitational constant G obtained by means of calculation of result to predetermine experimentally the Planck's constant of h that can be done by more simple and exact experimental means.

New possibility of solving the problem of integrating the gravitational and electromagnetic fields

The basis for solving the problem of integrating the gravitational and electromagnetic fields is two scientific discoveries: 1) The

determination of the frequency ν_p=7.4·10^{42}s^{-1} in the gravitational constant G (15), (17) [13]; 2) This allowed on a strict basis to determine the wave parameters of the gravitational field and find conditions for integrating it with electromagnetic field [16,17]. The initial one is the dependence (8), which allows to express the gravitational constant via the equation (15), and on the basis of it to determine the frequency ν_p=7.4·10^{42}s^{-1} (19), which is the only value of the frequency of the gravitational field:

$$\nu_p = \sqrt{\frac{c^5}{Gh}} == \sqrt{\frac{\left(0.299792458\times10^{9}\left(\frac{m}{s}\right)\right)^5}{6.673966969\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right)\times 6.626070040\times10^{-34}(J\times s)}} = 7.4\times10^{42}(s^{-1}) \quad (19)$$

Dependences (15) and (19) are sufficient for strict determination of frequency ν_p. Singling out exactly wave characteristics – frequency E_p, from gravitational constant G on the strict physical basis proves its connection with the frequency of gravitational field since G is a component part of gravitational force F_G, entering the law of universal gravitation (1).

Strict definition of frequency ν_p of gravitational field by dependence (19) has been obtained for the first time [16] and brings radical changes into the idea about its parameters and, finally, into the level of scientific cognition that conforms to all signs of scientific discovery [18]. Since the obtained value of frequency ν_p (19) coincides with the value (20), the other parameters (21), (22), (23) within the frames of wave dependences can be also considered to be strict wave parameters of gravitational field also having substance parameters (7)….(9) [10] and has no information of strict wave parameters of the gravitational fields is not a Nobel Prize in 2017 of Physics [16].

Period of oscillation:

$$T_p = t_p = \sqrt{\frac{hG}{c^5}} = 13.5135135\times10^{-44}(s), \quad (20)$$

Frequency of oscillation:

$$\nu_p = (T_p)^{-1} = \frac{1}{t_p} = \sqrt{\frac{c^5}{hG}} = 7.4\times10^{42}(Hz), \quad (21)$$

Length of carrier wave:

$$\lambda_p = \frac{c}{\nu_p} = l_p = \sqrt{\frac{hG}{c^3}} = 4.05124943\times10^{-35}(m), \quad (22)$$

Amplitude of oscillation:

$$A_p = l_p = \sqrt{\frac{hG}{c^3}} = 4.05124943\times10^{-35}(m). \quad (23)$$

Reliability of scientific statements put forward above and field and substance parameters of gravitational field obtained on their basic is confirmed by Nastasenko [17,18].

Unification of gravitational field with electromagnetic field. The complexity of unifying gravitational and electromagnetic fields being so difficult problem to solve can explained by the fact that till now their wave parameters were not Known, that's why it was not clear what and how can unified.

Taking into account the obtained wave characteristics (19)....(23) it can be strictly maintained that gravitational field can only by unified with electromagnetic field having the same wave characteristics. Thus, It can be summed up that unification of given fields is possible only on Plank's level. This conclusion is confirmed:

1) Indirectly by numerical equality of the values of wave (23), kinetic (24) and potential (25) energies within the framed of the laws known [1] for their clefinition:

$$E_p = h\nu_p = 6.626070040\times10^{-34} \\ (J\times s)\times 7.4\times10^{42}(s^{-1}) = 4.90329182969\times10^{9}(J) \quad (24)$$

$$E_p = m_p c^2 = 5.45564754\times10^{-8}(kg)\times\left(0.299792458\times10^{9}\left(\frac{m}{s}\right)\right)^2 \\ = 4.90329182969\times10^{9}(J) \quad (25)$$

$$E_p = m_p g_p l_p = 5.45564754\times10^{-8}(kg)\times 2.21846419\times10^{51}\left(\frac{m}{s^2}\right)\times 4.05124943\times10^{-35}(m) \\ = 4.90329182969\times10^{9}(J) \quad (26)$$

where g_p – Plank's acceleration of free fall (27)

$$g_p = \frac{l_p}{t_p^{\,2}} = \frac{4.05124943\times10^{-35}(m)}{(13.5135135\times10^{-44}(s))^2} = 2.21846419\times10^{51}\left(\frac{m}{s^2}\right) \quad (27)$$

2) Strictly by common for all these energies functional dependency (28) obtained by substituting in dependences (24)...(26) for dependences (19), (9), (7), (8) for Plank's parameters ν_p, m_p l_p, t_p which make them up:

$$E_p = h\nu_p = m_p c^2 = m_p g_p l_p = h\sqrt{\frac{c^5}{hG}} = \sqrt{\frac{hc}{G}}\times c^2 = \sqrt{\frac{hc}{G}}\times\frac{\sqrt{\frac{hG}{c^3}}}{\left(\sqrt{\frac{hG}{c^5}}\right)^2}\times\sqrt{\frac{hG}{c^3}} = \sqrt{\frac{hc^5}{G}} \\ = \sqrt{\frac{6.62607004\times10^{-34}(J\times s)\times\left(0.299792458\times10^{9}\left(\frac{m}{s}\right)\right)^5}{6.673966969\times10^{-11}\left(\frac{m^3}{kg\times s^2}\right)}} = 4.90329182969\times10^{9}(J) \quad (28)$$

Experimental proof of gravitational and electromagnetic fields unification is the hovering of ring superconductor (Figure 3) where direct current is induced resulting in the appearance of the magnetic field with frequency and amplitude of oscillation the same in size but opposite in phase of frequency and amplitude of gravitational field oscillation (other wave there wouldn't be the effect of hovering.

In this case obtained wave parameters of gravitational field (19)... (23) can be considered wave parameters of direct electric current.

Since it follows from dependency (19) that for gravitational field ν_p=*const*, then all other wave lengths. Except Planck's λ_p, the field unification is impossible that's why it is natural to exclude from this chain of transformations electric-weak and large unifications, or it is necessary to look for new regularities in the works that will follow to include them.

Within the frames of the analogies of gravitational and electromagnetic fields basing on the obtained wave parameters (19)… (23) it can be possible to define all other wave characteristics of gravitational field and to evaluate the possibility of interactions with

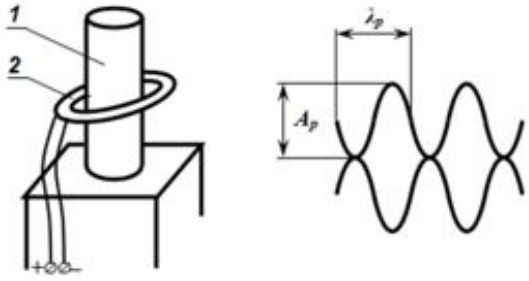

Figure 3: Diagram of hovering of ring superconductor 2, being cooled by a vessel of 1, the liquid helium by inducing direct electric current in it.

other objects and fields of material world that allows to deepen and widen the knowledge of the Universe.

This research work is presentation of 2nd International Conference on Quantum Physics and Quantum Technology, in Berlin Germany [19] and 3rd International Conference on Theoretical and Condensed Matter Physics in New York, USA [20].

General Conclusions and Recommendations

1. It's for that strictly formalized possibility of specifying gravitational constant *G* was shown by calculation based on other more exactly defined fundamental physical constants – Planck's constants *h* and speed of light in vacuum *c*, and corresponding regularities were found (19) and quantization of the value of 1 second with Planck's time t_p (12).

2. It's was for by calculation up to 9 characters which accurate, a new magnitude of gravitational constant $G = 6.673966969 \times 10^{-11}\left(\frac{m^3}{kg \times s^2}\right)$, that is 4 orders more exact than all known at present magnitude of *G* was obtained.

3. It's was for by perspective calculation up to 18 characters which accurate, a new magnitude of gravitational constant with the periodicity module |69|:

$$G = 6.67396|69|...\times 10^{-11}\left(\frac{m^3}{kg \times s^2}\right)$$

4. To confirm the obtained calculated data of new magnitude of gravitational constant *G* it is necessary to check up experimentally in new direct measurements the value of *G* and basing on them to calculate the trajectories of movement of natural and artificial space objects (especially – comets and asteroids approaching the Earth at the dangerous distance, that will allow to determine whether their collision is possible or impossible as early as possible).

5. Newly obtained physical regularities, laws and dependencies strictly follow from well known physical laws and regularities and do not oppose them.

6. Strictly obtained frequencies ν_p gravitational field from dependency (21) was obtained for the first time, and wave parameters connected with it were obtained for the first time in the paper [15] which bring radical changes into the notion about its parameters and in the end into the general level of scientific cognition that's why it meets all the requirements of scientific discovery [20].

7. Strict integration substantiation of gravitational and electromagnetic fields unification was obtained for the first time in the paper [17] and more precise definition was given by the dependencies (23)…(28) which bring radical changes into the general level of scientific cognition that it also meets all requirements of scientific discovery [20].

8. Strict constancy of the frequency of the waves of gravitational field $\nu_p = const$ (19), excludes the possibility of the unification of gravitational and electromagnetic fields on other levels except Plank's ones with wave length λ_p.

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