On the gravity force

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Abstract

An action of a gradient medium on the body immersed into it is considered. Bodies of different size that are in a gradient medium are demonstrated to acquire the same acceleration. On the basis of the concept of the ether medium representing a regular spatial lattice consisting of particles equal in size but opposite in sign, the mechanism of gravitational attraction of physical bodies is considered. It is shown that the gradient of the gravitational field established by a physical body in the ether medium is similar to the action of the gradient medium on the immersed body. Creating the gradient of the ether elastic pressure by a physical body in the vicinity of another physical body that also creates the gradient of the ether elastic pressure in the vicinity of the first body results in a rise of an attractive force called gravitation. The closeness of the experimental gravitational constant and the value obtained from the theoretical analysis indicates that the approach we have developed is fruitful and adequate.

Gravitational interaction is one of the four fundamental interactions in our world. In spite of more than three-century history of attempts, gravitation is the only fundamental interaction for which a noncontradictory theory has not been developed so far.

At present the general approach to the explanation of the gravitation phenomenon is missing. One should speak not about the gravitation theory as such, but about gravitation theories, for which classification not one but a few catalogues compiled on different principles ("pragmatic", "cosmological", "geometric" etc.) are required [1, 2]. Among the best known theories the most widespread are the following:

1. Scalar theories by Nordstrom, Einstein-Fokker, Whitrow-Morduch, Littlewood, Bergman, Paige Tupper, Einstein (1912), Rosen (1971), Papapetrou, No, Yilmaz, [Coleman], Lee-Lightman-No;
2. Bimetric theories by Rosen (1975), Restolla, Lightman-Lee;
3. Quasi-linear theories by Whitehead, Deser-Laurent, Bollini-Giambini-Tiomno;
4. Tensor theories by Einstein (1915) – General theory of relativity;
5. Scalar-tensor theories by Thiry, Jordan, Brans-Dicke, Bergmann, Wagoner, Nordtvedt, Beckenstein;
6. Vector-tensor theories by Will-Nordtvedt, Hellings-Nordtvedt;
7. Other metric theories;
8. Nonmetric theories include the theory of Cartan, Belinfante-Swihart and some others.

Some of the above theories are based on the assumption about the presence of gravitation radiation.

The latest issue of "Physical encyclopedia" [3, p. 188] describes the gravitation phenomenon in the following way: "Attraction (gravitation) is a universal interaction between any kinds of matter. If this interaction is rather weak, then the gravitation is described by the Newton theory. In case of rapidly varying fields and fast motions of the bodies gravitation is described by the general theory of relativity developed by A. Einstein. Gravitation is the weakest of the 4 types of fundamental interactions and in quantum physics it is described by the quantum theory of gravitation which is far from being completed".

Meanwhile, the importance of gravitation as a phenomenon as well as a force is great. It is at the basis of the mechanism controlling the motion of celestial bodies:

planets, stars, galaxies etc. On our planet Earth geological and atmospheric processes as well as many others are a consequence of the gravitation manifestation.

At present there is one fundamental constant related to gravitation. It is the gravitation constant. Its recommended value is $6.6742 \cdot 10^{-11}$, $m^3\ kg^{-1} s^{-2}$ with the relative error $1.5 \cdot 10^{-4}$ [4]. The gravitation constant was obtained experimentally and is in no way related to other fundamental constants. The importance of the fundamental constant – the gravitation constant is great. Determination of its physical links with other constants would be of great importance for explaining the gravitation mechanism and universe physics. We think the main agent transmitting the gravitation action of one physical body on another is the ether or the ether medium [5].

To explain the mechanism of the gradient medium action on the body in it, imagine an empty spherical reservoir of V volume in this medium, Fig. 1. Let the pressure gradient in this medium increase according to the linear law, $P = nt$, where n is some constant, t is the distance along the normal from the plane surface on which P = const. On the diagram presented in Fig. 1 the pressure increases in the direction from point l to point h, the upper edge of the sphere being level with the plane (free surface) at which $P = 0$. The sphere radius is equal to R. As is known, the volume of the ball of R radius is equal to:

$$V = \frac{4}{3}\pi R^3 . \qquad (1)$$

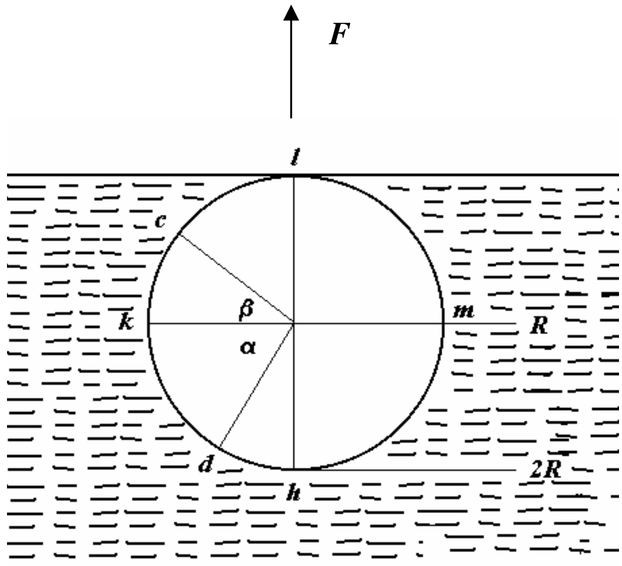

Figure 1. Diagram showing the action of forces on the body in the gradient medium.

We believe that the reservoir is in the medium whose density is δ. Let us also consider that the reservoir walls are strong enough and so thin that their weight can be neglected. The medium will exert the gradient pressure on the reservoir outer wall. It will rise as the depth of the point under consideration on the reservoir lateral surface increases. At the depth h the force applied to every point of the body will be $F_h = 2q\delta{\cdot}R$, where q is some acceleration that is given to the body at the given gradient of the pressure increase in the medium and at the given density δ. Consider that at every point of the medium the pressure (force) is transmitted hydrostatically, i.e. equally in value in all directions, to every outside site of the sphere except the surface with the point l at which the pressure will be equal to zero.. The force value at every point on the sphere surface can be calculated by formula $F_t = q\delta t$.

According to the rule of the parallelogram of forces, the value F_t can be expanded into two components – horizontal and vertical ones. The value of the horizontal component of the force F_g will be fully balanced by the same component at the opposite point located at the same distance t. The vertical component of the force F_v at the points located in the lower hemisphere, Fig. 1, will be only partly compensated by the vertical component acting in the upper hemisphere, since the distance t of the points on the surface of the upper hemisphere to the free surface is less than that of the points on the surface of the lower hemisphere.

To assess the value of the force acting on the body let us determine the sum of the forces F acting on the lower and upper hemispheres, Fig. 1. The vertical component of the force acting on the lower hemisphere when moving along the arc from point h to point k will change in the following way:

$$F_{vu} = q\delta R \sin\alpha(1+\sin\alpha) \tag{2}$$

The full force acting on the lower hemisphere F_l will be equal to a certain integral of the product of F_{vu} by the area of the lower hemisphere S with regard for the variable value of the vertical projection from point h to point k on which the force F_{vu} is acting

$$S = 2\pi R^2 \cdot \cos\alpha. \tag{3}$$

Thus,

$$F_l = 2\pi q\delta R^3 \{ \int_0^{\pi/2} \sin\alpha\cos\alpha d\alpha + \int_0^{\pi/2} \sin^2\alpha\cos\alpha d\alpha \} = \frac{5}{3}\pi q\delta R^3. \tag{4}$$

Similarly, we shall determine the vertical component of the pressure F_u on the upper hemisphere, Fig. 1. Applying the similar actions, we obtain

$$F_u = 2\pi q\delta R^2 \{ \int_0^{\pi/2} \sin\beta\cos\beta d\beta - \int_0^{\pi/2} \sin^2\beta\cos\beta d\beta \} = \frac{1}{3}\pi q\delta R^3. \tag{5}$$

One should take into account that vector F_u is in opposition to the force F_l acting on the lower hemisphere. So to obtain the value of the force F acting on the whole sphere it is necessary to subtract the expression (5) from expression (4). As a result we obtain

$$F = F_l - F_u = -\frac{4}{3}\pi q\delta \mathrm{R}^3,\ kg\ m\ s^{-2}. \tag{6}$$

The value F expresses the total force acting on the spherical reservoir of radius R that is in the gradient medium with the density δ. A comparison of formula (6) with formula (1) shows that if a body is filled with a medium, the weight of this medium will be exactly equal to the buoyant force applied to the empty body. Thus, a body immersed in a gradient medium experiences the buoyant force equal to the volume of the displaced medium. This law was proved by Archimedes for a body in the liquid that is in the Earth’s gravitation field.

We can imagine that a hermetic empty reservoir, Fig.1, is displaced in the direction of the pressure gradient increase for a distance of, for instance, t =100 R from the free plane. Then its lower point h will be at a depth of 102 R. Simple calculations show that here, too, force F (if the medium is incompressible) will be also determined by expression (6).

Thus, the body that is in the gradient medium will experience (within some conditions) the constant in value force oriented normally to the equipotential surfaces of the equal gradient and directed to the gradient decrease. If the medium has the density δ, then the force acting on the body will be equal to the product of this density by the body volume V:

$$F = -V \cdot q\delta,\ kg\ m/s^2. \tag{7}$$

Under force F the free from external links reservoir, Fig.1, will be in accelerated motion in the direction of the pressure gradient decrease. If the phenomena of viscosity, internal friction in the medium etc. are neglected, the value of this acceleration q will be equal to

$$q = -F/V\delta. \tag{8}$$

Imagine another body whose volume is K times different from the volume V of the first body. According to formula (7), force F_k acting on the other body will be also K times different from the force acting on the first body:

$$F_k = -KV\,q\delta \tag{9}$$

At the same time its acceleration will remain the same since both the force and volume changed K times.

$$q = -F_k / KV\delta = -KVq\delta / KV\delta = q \tag{10}$$

This implies an important conclusion: **bodies of different volumes that are in the same gradient medium acquire the same acceleration.** This conclusion is valid for bodies that are in the gradient medium whose pressure decreases (increases) by the linear law. The free from external links body with the specific density that is unlike the liquid density will be in accelerated motion. Its motion vector will be directed along the normal to equipotential surfaces that undergo the medium equal pressure. Bodies of different volumes will be in uniformly accelerated motion if the medium does not offer viscous or some other resistance.

Note that if we keep watch on the fall of bodies of different masses and volumes in the Earth's gravitation field under conditions when the effect of the air resistance is minimized (or excluded), the bodies acquire the same acceleration. Galileo was the first to establish this fact. The most vivid experiment corroborating the fact of equal acceleration for bodies of different masses is a fall of a lead pellet and bird feather in the deaerated glass tube. Imagine we start dividing one of the falling bodies into some parts and watching on the fall of these parts in the vacuum. Quite apparently, both large and small parts will fall down with the same acceleration in the Earth's gravitation field. If we continue this division down to atoms we can obtain the same result. Hence it follows that the gravitation field is applied to every element that has a mass and constitutes a physical body. This field will equally accelerate large and small bodies only if it is gradient and acts on every elementary particle of the bodies. But a gradient gravitation field can act on bodies if there is a medium in which the bodies are immersed. Such a medium is the ether medium [5]. The ether medium has a gradient effect not on the outer sheath of a body (a bird feather or lead pellet), but directly on the nuclei and electrons constituting the bodies. That is why bodies of different densities acquire equal acceleration.

Equal acceleration of the bodies of different volumes and masses in the gravitation field also indicates such an interesting fact that **it does not matter what external volume the body has and what its density is. Only the ether medium volume that is forced out by the total amount of elementary particles (atomic nuclei, electrons etc.) matters.** If gravitation forces acted on the outer sheath of the bodies then the bodies of a lower density would accelerate in the gravitation field faster than those of a higher density. A light body of the same volume as a heavy one would experience the same accelerating force and, according to Newton's second law, would move faster. In this case a correspondens between inertial and gravitational masses would also be missing. But this correspondens is repeatedly confirmed by experiments [6, 7].

The examples discussed above allow clarifying the action mechanism of the gravitation force of physical bodies on each other. Newton was the first to presume that there is a certain relation between the gravitation mechanism and Archimedean principle [8]. The medium exerting pressure on a gravitating body is the ether. According to our ideas [5], the ether medium consists of particles with positive and negative charges located chequer-wise in the sites of a regular lattice, Fig. 2. This notion is corroborated by a well-known fact concerning an appearance of electron-positron pairs in vacuum in the flows of high-energy particles [9].

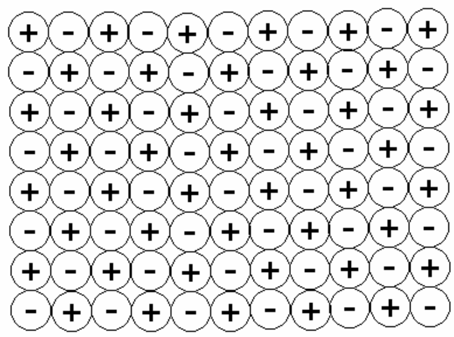

Fig. 2. The structure of the ether medium consisting of particles of two kinds that are opposite in charge (projection on the plane).

In the presented Figure particles of two kinds - positive and negative are pictured as geometrically similar spheres closely contacting each other. The nature of their charges is electric. Undoubtedly, to form a spatial lattice, these elementary particles should attract each other with a great force.

The ether medium, Fig. 2, is a basis for propagation of radio waves, X-rays and other types of electromagnetic oscillations. These waves propagate both in the free ether and in physical (gaseous, liquid, solid etc.) bodies composed of elementary particles. A basis of the light propagation inside physical bodies is also the ether. But inside the elementary particles possessing a mass the ether medium is absent. This is, for instance, indicated by diffraction effects, dispersion of hard X-ray waves on the atom electrons and nuclei [10, 11].

Close to an elementary particle, the regular lattice, Fig. 2, cannot be preserved due to distortions introduced by the particle. Figure 3 gives a simplified structure of the ether medium near a conventional atomic nucleus (electron etc.) as an elementary spherical mass [5]. This diagram is conventional because the sizes of such a mass, for instance, atomic nucleus, electron etc. are much greater than those of the ether medium particles.

This diagram shows that a spatial-netlike structure of the ether is distorted by the availability of an elementary spherical mass. Close to the elementary mass this structure is greatly loosened. The farther from the elementary mass, the less is the loosening degree of the structure.

The comparison of Figures 2 and 3 shows that the ether structure with no elementary particles near it has the greatest density. The structure distorted by the presence of an elementary mass has a lower density. The spatial- netlike structure formed by unlike particles attracting each other, develops great pressure at their contacts, as shown in the paper [5]. The pressure will be also exerted on the elementary mass, Fig. 3. This pressure will be built up due to the contact breaking between the unlike particles immediately adjacent to this mass. The pressure on the mass will be intensified due to the distortion of the second, third, fourth etc. series of the structural lattice that are, accordingly, in the second, third, fourth row from the mass. This pressure is caused by the tendency of the particles in the second, third etc. series to be in contact with each other and to restore the densest structure, Fig. 2.

At some distance from the elementary mass centre, the general view of the structural medium can be conventionally presented as concentric nested spheres, Fig. 4.

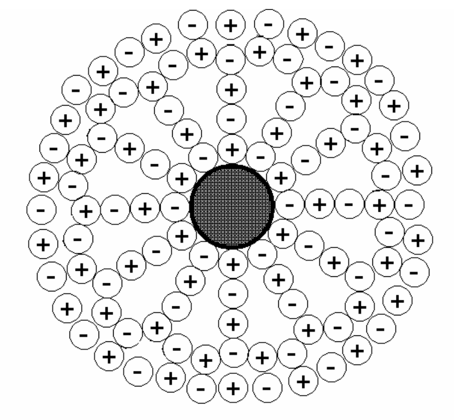

Fig. 3. A simplified diagram of the spatial-netlike structure of the ether in the vicinity of an elementary spherical mass.

By mere convention one can believe that in the middle concentric sphere (1, Fig. 4), all unlike particles are in direct contact with each other without spaces. Then in the concentric sphere located further from the mass (2, Fig. 4), the spaces between the particles will appear since the number of the unlike particles should correspond to each other. In the concentric sphere located nearer to the elementary mass (3, Fig. 4), the particles arrangement will be also less dense, since it is impossible to place here the same number of particles as in the middle sphere. A number of particles from the near sphere will be forced out and the empty spaces will occupy their place. It is easy to imagine that as the ether medium moves away from the elementary mass its density will increase and its “looseness” will decrease proportionally to the distance from this mass.

Thus, if we imagine some mass M_1 (an elementary particle) and place it inside the undisturbed ether medium, Fig. 2, this mass will distort the ether medium structure in the way it is conventionally shown in Fig. 3. The elementary mass will experience the greatest pressure equal from all sides. Let us displace this mass in the medium that has already been distorted by the presence of the same elementary mass, Fig. 5. In this case the pressure will not be equal from all sides. The mass will appear under pressure of a great number of concentric layers of different curvature depending on the distance to another elementary mass. The concentric layers of lesser curvature will exert greater pressure on mass $M_{1.}$ The pressure exerted by the layers with greater curvature located closer to the elementary mass, will be lower. Thus, the ether medium in the influence area of the mass M_1 appears to be gradient. The vector of this gradient decrease is directed to the other elementary mass $M_{2.}$ In its turn, the force pushing mass M_2 to mass M_1 will be applied. This is the principle basis for gravity forces in the ether medium consisting of equal particles that are opposite in sign.

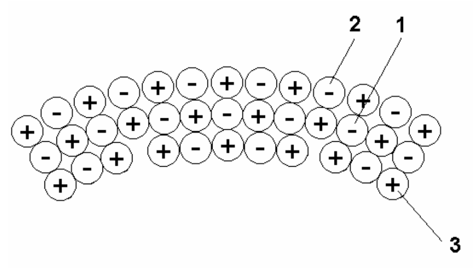

Fig. 4. A fragment of the ethereal medium structure at some distance from the physical mass.

Thus, a loose gradient ether medium is the space to which elementary masses are forced out from the space area with the denser ether medium. If the lattice is crooked, for instance, due to the presence of some mass inside the lattice, it has a lower density. In this crooked lattice, another mass will move in the direction of the decrease of the lattice density gradient (or otherwise in the direction of higher "looseness").

From the above ideas it is rather easy to find out the reason for a rise and action of the bodies' gravitational gradient. Assume that along the circumference L_1 of concentric layer 1, Fig. 6, formed around the elementary mass $M_{1,}$ an exact number n of particles opposite in sign of diameter d fit or $L_1 = n_1 d$.

Let us consider that $L_1 >> d$. The radius of such a circumference will be equal to $R_1 = n_1 d/2\pi$, and the number of particles $n_1 = 2\pi R_1/d$. As follows from our model, the next concentric layer with the circumference L_2, that is closer to the elementary mass will have the radius R_2 which is less than the first radius by the value of the particle size d, $R_2=R_1 - d$.

The circumference of layer 2 will be $L_2 = 2\pi R_2 = d\ (n_1 - 2\pi)$, and the number of particles $n_2 = 2\pi(R_1 - d)/d$, or else $n_2 = n_1 - 2$. Accordingly, the number of particles that fit layer 2 will be 2π less than along the circumference $L_{1.}$ On the other hand, every particle of the circumference L_1 should be corresponded by the other particle of the opposite sign from layer 2. Then at the cost of the number of particles in the second concentric layer $n - 2\pi$, 7 particles of the first layer will not be compensated. So the particles of layer 2 will be wider apart than those of the first layer. Thus, within concentric layer 2 some vacuum of the ether medium is formed.

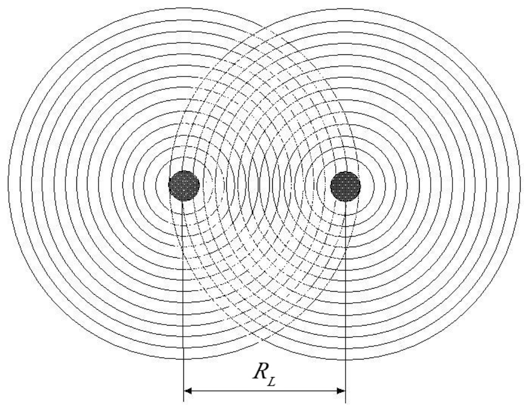

Fig. 5. Gravitational field established by two gravitating masses.

In some k-layer that is closer to the centre by the value of kd, the number of particles that fit along the circumference will be $n_k = n_1 - 2k\pi$. The value of the ether medium vacuum in the k-layer in relation to the first layer can be expressed by the factor reflecting the ratio of the particles number in every layer to their circumferences:

$$\Delta_k = (n_1 - 2k\pi)/n_1 = 1 - 2k\pi/n_1 \qquad (11)$$

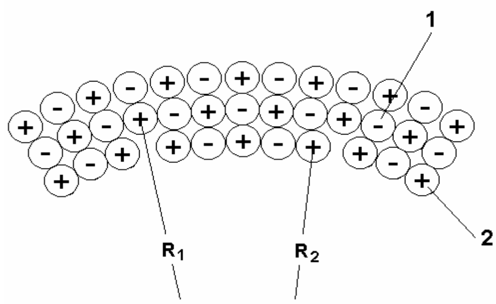

Fig. 6. Diagram for calculation of the number of the ether medium particles in the concentric layers around the physical mass.

In fact, formula (11) with great numbers of n expresses the variation in the diameter (radius) or curvature of the concentric layers within which, in an ideal case, the ether particles take place.

It is easy to show that as the distance from the centre increases, the curvature (for spherical surfaces) decreases proportionally to the sphere radius. The degree of the vacuum medium "looseness" will decrease proportionally to the increase in the surface area of this sphere. Accordingly, the pressure on some test body will increase proportionally to the squared distance. In this case the gradient of this pressure will decrease inversely to the squared distance. The gravitation gradient of the bodies will also decrease.

Thus, a physical body creates the gradient of the ether elastic pressure in the vicinity of another physical body which also creates the gradient of the ether elastic pressure in the vicinity of the first body. This phenomenon causes a rise of the force that makes the bodies approach each other. This is the reason for attraction or gravitation.

The ether medium, as shown above, has some properties of an ideal liquid and solid body. Unlike a real liquid, essentially it does not possess viscosity and does not exhibit resistance (accompanied by transformations of energy kinds) to moving bodes. The ether medium particles are rigidly bound by mutual attraction [5]. The ether medium has a certain peculiar density δ [12, 13]. We have also shown that all known physical bodies (bodies possessing a mass since they consist of elementary particles) are permeable for the ether medium. Thus, using bodies composed of a combination of atoms or molecules, we are not able to construct a reservoir similar to that shown in Fig. 1 and which would be free from the ether medium inside. But the ether medium, as our concept states, is forced out by the strong fields that exist near and inside nuclei, electrons and other elementary particles possessing a mass. In this sense, these particles are analogues of the ether free reservoirs, Figs 1, 3. In the gravitational field, the elementary particle of mass M_i experiences force F that induces the particle, as in the case with the floating body, to move from the areas with greater pressure to the area with lesser one.

Force F_i will be proportional to the volume of particle M_i, which reflects the volume of the ether medium forced out by the particle. The force will be also proportional to the density of the medium forced out, i.e. to the ether. This force will also depend on the ratio of the gravitational (mechanical) and electromagnetic forces in the ether medium.

Let us use formula (7) to reflect force F_i that acts on the elementary particle forcing out some volume V_i of the ether of density δ by its internal forces.

$$F_i = \tau\delta V_i, N \qquad (12)$$

Here τ is some factor of proportionality reflecting the uncertainty of the volume V_i value in a general case and the distinction of the ether density δ from the density of physical bodies.

The ether medium density is of an electromagnetic nature, so it cannot be directly compared with the density of physical bodies. As determined earlier [13], in the system SI it is equal to:

$$\delta = \mu_0 = 1.25664 \cdot 10^{-6}, m\ kg \cdot s^{-2} a^{-2}, \qquad (13)$$

It should be kept in mind that the force F_i will be only about the same as the one with which the body $M_i = M_1$ will be attracted by the other gravitating body M_2.

The reason is that every mass establishes the gradient of the gravitational field around itself that acts upon the other mass as well, Fig. 5. The mass M_1 that forces out the volume V_1 of the ether medium creates the ether pressure gradient at the distance R. In its turn the mass M_2 that is at a distance of R from the mass M_1 forces out the ether volume V_2. The pressure gradient from the mass M_1 falls off at the place of M_2

location proportionally to $1/(R)^2$. The same fall occurs from the mass M_2 at the place of M_1 location. Their acceleration q, as mentioned above, will be the same. If the mass M_1 or M_2 is equal to zero the attractive force will be absent. Accordingly, if one of the masses is vanishingly small the attractive force will be identically small.

On this basis and taking into account Eq. (12), the mutual attractive force of the two masses M_1 and M_2 will be:

$$F_D = -\frac{\tau^2 \delta^2 V_1 V_2}{R^2}, \tag{14}$$

where V_1 and V_2 are the ether volumes forced out by masses M_1 and M_2, accordingly, R is the distance between the masses.

It is known that a sphere contains the greatest volume per its surface unit. From the principle of minimum of free energy, a sphere is also a preferable form that matter occupies in the uniform force field. In this connection, it is logical to suppose that, for instance, the figure of the near-nucleus space within which nuclear forces push out the ether medium, most often represents a sphere. Indeed, in nonexcited state the electric depole moment is equalto zero [9]. A similar conclusion can be drawn about the figures of other elementary particles. Then we can present the volumes in formula (14) as $V_1 = \frac{4\pi}{3} r_1^3$ and $V_2 = \frac{4\pi}{3} r_2^3$, where r_1 and r_2 –are efficient radii of elementary masses M_1 and M_2.

If we put the values of V_1, V_2 and δ [see (13)] in formula (14) we obtain

$$F_D = -2.771 \cdot 10^{-11} \tau^2 q \frac{r_1^3 r_2^3}{R_L^4}, \; N \tag{15}$$

In order to get the force F_D value in newtons in formula (15), the value $\tau^2 q^2 r_1^3 r_2^3$ should be given dimensionality $m^{-4}\, kg^{-1} \cdot s^4 a^4$.

As is known, Newton's law of gravity in the context of classical mechanics is formulated in the following way: the force of gravitational attraction between two material points of masses M_1 and M_2 separated by distance R is proportional to both masses and inversely proportional to the distance squared [14]:

$$F_T = -G \frac{M_1 \cdot M_2}{R^2}, \tag{16}$$

Here G is the gravitational constant equal to $6.6742 \cdot 10^{-11}$, $m^3\, kg^{-1}\, s^{-2}$ [4].
The minus sign means that the force acting on the body is the radius-vector directed to the body. The law of gravitation is one of applications of the inverse-square law. It is a direct consequence of the quadratic increase in the sphere area with increasing radius. This law in the form presented by Eq. (16) was deduced from an experiment and later on it was repeatedly corroborated [7, 15].

When analysing Eq. (16) one should take into account that masses M_1 and M_2 are not point ones and real bodies consist of molecules and atoms. Molecules, too, consist of atoms. The main mass in every atom is concentrated in the nucleus and to a lesser degree in electrons that rotate around the nucleus. The proton mass is 1.6723 10^{-27} *kg*, the neutron – 1.6746 10^{-27} *kg* [11]. The rest mass of an electron is about three orders of magnitude less – 9.108 10^{-31} *kg*. The proton size (radius) is 8.768 10^{-16} *m*. The neutron size is about the same as that of a proton. Thus, every mass – M_1 and M_2 represents the sum of a great many masses of nuclei and electrons. At the same time, the sizes of atoms, including their electron shells, are fractions and units of an angstrom – Å = 1 10^{-10} *m*. The nuclei sizes are of order 10^{-15} *m* [11]. The comparison of these sizes shows that if we imagine the atom nucleus of 1 *cm* size, the boundary of the atom will appear to be at a distance of 100 *m*. On this basis the masses M_1 and M_2 represent a dispersal of nuclei and electrons in the form of a very sparse net. These aspects allow understanding that the empirical formula (16) does not reveal the entire complexity of the gravitational interrelations between physical bodies.

If we place two identical bodies of 1 *kg* mass each at 1 *m* from each other, then from formula (16) we obtain that their attracting force is:

$$F_{TO} = -\,6.6742\cdot 10^{-11},\ N. \tag{17}$$

For the same conditions ($r_1 = r_2 = r$, $R_L = 1$ *m*), from formula (15) we obtain:

$$F_{DO} = -2.771\cdot 10^{-11}\tau^2 r^6,\ N. \tag{18}$$

A comparison of numbers in formulas (17) and (18) shows the same order. The difference between the theoretically calculated value of the attraction force of the two bodies of 1 *kg* each located at a distance of 1 *m* and the experimental value of the gravitational constant with $\tau^2 r^6 = 1$, is $F_{TO} - F_{DO} = 3.903\cdot 10^{-11}$. If the multiplier in formula (18) is equal to

$$\psi = \tau^2 r^6 = 2.408, \tag{19}$$

then the numerical value of F_{DO} will be equal to the gravitational constant G.

The presence of the multiplier ψ can be explained by three reasons. The first one is the difference between the ether specific density δ and the density of physical bodies. The ether medium density has another dimensionality ($N\cdot a^{-2}$), than the mass (*kg*) or weight (*N*) of a physical body. As the recent discovery of the so-called “hidden matter” [16] showed, despite a different physical nature, the ether interacts intensively with the density of common physical bodies.

The second reason is that the ether medium near an elementary mass has a lower density; its lattice is distorted [17]. In the vicinity of the elementary mass the gradient of the ether density reduction (increase in its “looseness”) is formed, this gradient being directed to this mass. This is corroborated by the fact that the harder electromagnetic waves are (their frequency is higher), the more intensively they interact with the nuclei of a physical body. This interaction, viz diffraction of X-rays on atoms constituting regular crystals, was predicted by Laue in 1912 and first observed experimentally by Friedrich and Knipping [10].

Every physical body is composed of an ensemble of atoms (molecules), which, in turn, are composed of elementary masses, i.e. nuclei, electrons and other elementary particles. For instance, a sample of 1 *kg* composed of pure carbon contains about 5 10^{25} atoms. Atoms of matter are composed of protons, neutrons and electrons which represent not a single volume, but a set of volumes constituting a ponderable physical body. So one can speak about only the effective radius *r* of all elementary volumes of the ether medium forced out of a physical body. This is the third basis for the presence of the multiplier ψ.

Conclusion

We have considered the action mechanism of a gradient field on an empty sphere and arrived at the following important conclusion. **Bodies of various volumes that are in one and the same gradient medium acquire one and the same acceleration**. The same can be observed in the gravitation field of the Earth and other celestial bodies.

Gravitation forces act not on the outer shell of a physical body but on the elementary particles constituting it**. It does not matter what external volume the body has and what its density is. Only the volume of the ether medium that is forced out by the total amount of the elementary particles (atomic nuclei, electrons etc.) matters.**

The medium that exerts pressure on a gravitating body is ether. The ether medium consists of particles with positive and negative charges located at the sites of the regular volume lattice staggered-order. All known physical bodies (bodies that have a mass as they consist of elementary particles) are permeable for the ether medium.

The ether is the medium in which the gravitation gradient is created as a result of the presence of a physical body in it. The ether passes the influence of this gradient (attraction) to other bodies. Therefore the transmission velocity of gravitation influence of one body on the other is equal to the velocity of electromagnetic oscillations (light) in the ether.

Creating the ether's gradient of elastic pressure by a physical body in the vicinity of another physical body that creates the ether's gradient of elastic pressure in the vicinity of the first body, gives birth to the force that makes these bodies approach each other. This is just the reason for attraction or gravity.

The proximity of the experimentally obtained value of the gravitation constant to the value obtained in the course of the theoretical assessment demonstrates fruitfulness and adequacy of the approach we have developed.

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