

Space and Gravity

Anatoly V. Belyakov

Tver, Russia. E-mail: belyakov.lih@gmail.com

Based on the mechanistic interpretation of J. Wheeler's geometrodynamics, where space has the properties of an ideal fluid surface, it was found that the ratio of the forces acting in the surface wave transverse component to the forces acting in its longitudinal component is equal to the ratio of the electric forces to the gravitational ones. The surface of a finite thickness is the original material entity, the fractalization of which leads to forming material bodies and the tension of the above surface, which is manifested as an attraction between the bodies. The speed of light has been determined and the gravitational constant calculation formula has been obtained. It is concluded that a radiating cell of the surface wave generates a radiation having the wavelength corresponding to the background radiation maximum.

1 Introduction and main provisions

Geometrodynamics, introduced by the famous scientist John A. Wheeler, who died in 2008, does not seem to be approved by modern physicists, since it requires the presence of some medium (ether). According to Wheeler's concept, charged microparticles are singular points on a non-unitary coherent connected two-dimensional surface of our world, connected by a "wormhole", a vortex tube or a current force line of the drain-source type in an additional dimension, forming a closed contour [1]. But "wormholes", if they are not considered purely mathematical constructions, in their physical embodiment can only be the vortex formations based on the surface (or phase boundary) of some substance that has the properties of an ideal fluid.

The presence of contours (vortex tubes) is also postulated, for example, in [2], where the vacuum structure is considered as a network of one-dimensional flow tubes (knotted/linked flux tubes), and it is claimed it is such a network that provides the spatial three-dimensionality of the Universe. At the same time this network, infinitely densely filled with such vortex formations, forms a continuous surface (the possibility of this was proved in the 19th century by J. Peano [3]). This surface, in turn, as it becomes more complex, can form three-dimensional material objects, which are, in fact, highly fractalized, up to the parameters of the microworld, *surfaces* with a fractional dimension. An undeformed (non-fractalized) surface is equivalent to the empty space, and bodies when driving in such a continuous medium does not feel any resistance up to the speed of light, i.e., until surface waves forms, and *for any observer the vacuum medium remains undetectable*. Recall that even when moving in a real liquid body, an observer does not feel a resistance up to the speed when a surface wave is formed (for water, the speed is 0.3...0.5 m/sec).

As for a completely entire three-dimensional body, it does not have an internal structure, does not carry any information about its structure (except for its own mass), and such bodies do not really exist. The fact that all objects are fractalized

surfaces is especially well manifested in the organic world: under the surface of outer shells there are the surfaces of organs, vessels, then – the surfaces of their fibers, then – the surfaces of cells, etc.

The Wheeler model's closest analogy on the scale of our world would be the ideal fluid surface, the vortex formations arising in it and corresponding interactions between them. In the mechanistic interpretation of Wheeler's idea, the charge reflects a measure of the medium nonequilibrium and is proportional to its momentum along the vortical current tube contour, spin, respectively, is proportional to its angular momentum relative to the contour longitudinal axis, and magnetic interaction between the conductors is similar to the forces acting between the current tubes. In this model, a point or a line is considered to be physical objects with certain dimensions, where the electron volume with mass m_e and radius r_e can be taken as a medium unit element. A free charged particle in such a scheme is represented as part of an open contour or a unipolar vortex resting on the surface of our world and directed along the "extra" dimension, where the particle charge and spin are determined by the "hidden mass" dynamics [4].

In such a model, the electric constant becomes the density per unit of the vortex tube length

$$\varepsilon_0 = \frac{m_e}{r_e} = 3.23 \times 10^{-16} \text{ kg/m}, \quad (1)$$

and the reciprocal of the magnetic constant is the centrifugal force

$$\frac{1}{\mu_0} = c^2 \varepsilon_0 = 29.06 \text{ N}, \quad (2)$$

arising from the rotation of the vortex tube element with mass m_e , at the speed of light c along the radius r_e ; it is also equivalent to the force acting between two elementary charges at this radius.

The paper [4] defines the vortex thread parameters: its mass M , circumferential velocity v , radius r , and length l for

an arbitrary p^+e^- -contour in dimensionless units of m_e , r_e and c :

$$M = l = (an)^2 \quad (3)$$

$$v = \frac{c_0^{1/3}}{(an)^2}, \quad (4)$$

$$r = \frac{c_0^{2/3}}{(an)^4}, \quad (5)$$

where n is the main quantum number, a is the reciprocal of the fine structure constant, c_0 is the dimensionless speed of light, c /[m/sec].

This approach has justified itself in determining the electron charge and radiation constants numerical value and other parameters both for the microworld [4, 5, 6, 7] and for cosmological objects [8]. The mechanistic interpretation of geometrodynamics does not introduce any additional entities, but, on the contrary, reduces them. So, the Coulomb is excluded from the set of dimensions and is replaced by the electron limiting momentum, which radically simplifies all the dimensions associated with electromagnetism [9].

2 On the surface wave parameters

The speed of light is one of the few fundamental quantities not derived in theory. However, as established in [10], it turns out the propagation of light to be similar to wave's moving on the liquid surface and *has the maximum equal to the speed of light*, which is determined from the well-known equation

$$v^2 = \frac{g\lambda}{2\pi} + \frac{2\pi\sigma}{\rho\lambda}, \quad (6)$$

where g is the acceleration, λ is the wavelength, σ is the surface tension (force relative to the perimeter), ρ is the specific density. The first term reflects the gravity effect on the wave speed, the second – the surface tension effect.

When this equation was solved, a radiating cell (toroid) was considered, in which the medium circulates along the contour with radius $R = a^2n^2r_e$ and rotates helically about the toroid longitudinal axis, creating z structurally ordered units (waves or photons) with centrifugal acceleration $g = zv^2/R$. The surface tension was defined as $(1/\mu_0)/R$, and the specific density as $m_p m_e / R^3$, where m_p is the relative proton mass in units of m_e .

The solution obtained, can be considered as a special case of the wave velocity maximum at $n = 4.23$ and does not depend on the parameters n and z . However, unlike a liquid where the surface wave velocity has a minimum, and, actually, their capillary and gravitational waves velocity depends on the surface tension and the basin depth, there is some natural mechanism for electromagnetic waves ensuring of their speed from the wavelength independence.

Let us express the wavelength from (6). Assuming $v = c$, after transformations we get (a plus radical formula is accepted)

$$\lambda = \frac{\pi r_e a^6 n^6}{c_0^{2/3}} \left[1 + \left(1 - \frac{4c_0^{2/3}}{a^2 n^2 m_p} \right)^{1/2} \right]. \quad (7)$$

The critical value $n = 0.227$ corresponds to the wavelength minimum value

$$\lambda_{min} = \frac{\pi r_e a^6 n^6}{c_0^{2/3}} = 1.81 \times 10^{-11} \text{ m}, \quad (8)$$

which is already gamma radiation. Thus, for $n < 0.227$, either a more accurate equation is required, or the radiation already completely loses its longitudinal component and becomes the capillary waves analogue; anyway, it is known gamma rays to behave like particles at $\lambda < 10^{-10}$ m.

It should be borne in mind that, as applied to (7), the parameter n determines the radiating cell physical size, i.e., the circular trajectory size, along which particles move under the surface in the liquid medium under the action of gravitational forces (in contrast to the proton-electron system main quantum number, which characterizes the atom excited state). Note that at $n = 4.23$, when $v = c$, from (7) follows $\lambda = 1.52 \times 10^{-3}$ m, which corresponds to the *background microwave radiation maximum*. Thus, it turns out the optimal radiative cell at which the wave speed is compared with the speed of light to be the cosmic background radiation natural source or, at least, be its longitudinal component.

As shown in [5], the proton-electron contour parameters are determined from the condition of the equality of the magnetic repulsive forces and gravitational attractive forces, which in the Coulombless form has the form

$$\frac{z_{g1} z_{g2} \gamma m_e^2}{r^2} = \frac{z_{e1} z_{e2} \mu_0 m_e^2 c^2 l}{2\pi r \times [\text{sec}^2]}, \quad (9)$$

where z_{g1} , z_{g2} , z_{e1} , z_{e2} are the gravitational masses and charges in the masses and charges of an electron, γ is the gravitational constant.

The largest contour size is possible when the entire proton mass, corrected for the Weinberg projection angle Θ , is involved in the circulation contour. Then at $z_{g2} = m_p / \cos \Theta$ for unit charges after transformations we obtain the geometric mean from (9) in units of r_e

$$l_k = (lr)^{1/2} = \left(\frac{m_p}{\cos \Theta} \right)^{1/2} (2\pi\gamma\rho_e)^{1/2} \times [\text{sec}], \quad (10)$$

where ρ_e is the specific electron density m_e/r_e^3 , $\Theta \approx 28.70^\circ$ is the Weinberg angle.

The l_k parameter is compound. Taking into account (3), (5) and (10), the values of l and r in units of r_e have the form:

$$l = \frac{c_0^{2/3}}{l_k^2}, \quad (11)$$

$$r = \frac{l_k^4}{c_0^{2/3}}. \tag{12}$$

Taking the parameter r as the major axis of the contour, bearing in mind (3) and (12), from (10) the limiting quantum number is determined

$$n_{max} = 2\pi \frac{m_p}{\cos \Theta} \frac{\gamma \rho_e \times [\text{sec}^2]}{ac_0^{1/3}}. \tag{13}$$

It follows from (13) that $n_{max} \approx 390$, then the largest circulation contour size (the surface wave depth) is $390^2 a^2 r_e$, and the recombination wavelength $\lambda_{max} = n^2 / R_\infty = 0.0139$ m, where R_∞ is the Rydberg constant. This result is consistent with the fact that there are no excited hydrogen radio lines at $n > 301$ even in open space [11]; recombination radio lines with more n were detected only in absorption and not from hydrogen, but from the hydrogen-like atoms [12].

As for the parameter n as applied to the radiating cell, even at λ_{max} , as it follows from formula (7), $n \approx 6$. That is, the hydrogen atom radiating cell size (this cell is, as it were, the analogue of an antenna) at any possible wavelength does not go beyond the VI-th period atoms size (the atoms containing electrons in the seventh shell are unstable). The location of an electron at a greater distance from the nucleus is his excited and short-term state.

The longitudinal waves length, apparently, will be determined by the same equation (6) and, if it is limited not by $n = 6$, but by $n_{max} = 390$, then their length can be very large. Perhaps, in some range, electromagnetic waves also have a longitudinal component, since there are studies indicating the existence of longitudinal electromagnetic waves [13].

3 Determination of the gravitational constant

Let us consider an extremely simplified scheme of a single radiating cell, when a medium with an arbitrary mass m circulates along the toroid contour with a radius R , and at the same time it also rotates in the spiral about the toroid longitudinal axis in a radius r . The surface wave is known to have longitudinal and transverse components. Let the circulation along R occur under the action of gravitational forces with acceleration v^2/R , and the spiral rotation along r occur under the action of surface tension forces (capillary forces) with acceleration v^2/r . Considering the surface wave components separately, it is logical to correlate these components with gravitational waves and electromagnetic waves. One can say the electromagnetic oscillations to form, as it were, a small ‘‘ripple’’ on the surface of gravitational waves. Such ripples – a real physical analogue – are easy to observe on the water surface over its ordinary disturbance.

So, it is possible to draw up the single ratio of electric forces to gravitational ones, or, bearing in mind the equality of masses, the ratio of accelerations, which will be the largest under extreme conditions, i.e., it should be equal to

the value $c^2 r_e / \gamma m_e$, where the gravitational constant should be considered unknown. For the transverse component, the highest velocity $v = c$, and the vortex thread smallest size r is the circumscribed circle size around three Planck dimensions r_h , which from geometric constructions is equal to

$$r = r_h \left(1 + \frac{2}{3^{1/2}} \right), \tag{14}$$

where

$$r_h = \left(\frac{\hbar \gamma}{c^3} \right)^{1/2}, \tag{15}$$

and

$$\hbar = am_e r_e c, \tag{16}$$

since it has been established the quantity r_h to have a physical meaning and be the neutrino vortex thread minimum size [14].

For the longitudinal component, bearing in mind (4), the lowest speed

$$v = \frac{c_0^{1/3} c}{(an_{max})^2} \tag{17}$$

and, bearing in mind (3), the largest radius (contour length)

$$R = (an_{max})^2 r_e. \tag{18}$$

Thus, for the largest ratio of accelerations, taking into account the above and bearing in mind (17) and (18), one should write

$$\frac{(an_{max})^6 r_e}{c_0^{2/3} r} = \frac{c^2 r_e}{\gamma m_e}. \tag{19}$$

As a result, bearing in mind (14), (15), (16) and separating the parameter γ , after transformations from (19) we obtain:

$$\gamma = \left(1 + \frac{2}{3^{1/2}} \right)^{2/13} a^{1/13} c_0^{16/39} \left(\frac{\cos \Theta}{2\pi m_p} \right)^{12/13} \times w_e \left(\frac{c}{r_e} \right)^{2/13} \times [\text{sec}^{-24/13}], \tag{20}$$

where w_e is the electron specific volume, equal to r_e^3 / m_e , $m_p = 1836.2$.

This equation is exact, but the Weinberg angle Θ (parameter in the electroweak interaction theory) is determined experimentally and lies within $28.13^\circ \dots 28.75^\circ$, i.e., $\cos \Theta = 0.882 \dots 0.877$. However, it can be calculated as the projection angle [4], and in this case

$$\cos \Theta = \frac{c_0^{1/6}}{(2\pi a)^{1/2}} = 0.882, \tag{21}$$

and also as the radius to circumference reduced ratio [5]

$$\cos \Theta = \left(\frac{1}{2\pi} \right)^{1/14} = 0.877, \tag{22}$$

and in other ways, which gives the same results. It can be assumed that the currently observed experimental data inconsistency when determining the gravitational constant is associated not so much with the Weinberg angle's uncertainty, and how much with the projection uncertainty of "hidden" parameters on the selected direction of our world, i.e., with the position uncertainty of the medium velocity vector relative to this selected direction [4].

Interestingly, the product of geometry-related parameters $(1 + 2/3^{1/2})^{2/13}(\cos \Theta)^{12/13}$ is very close to 1, which is apparently not accidental. Indeed, the fundamental constants formulas, such as r_h , \hbar , r_e , also do not contain geometric coefficients. Formula (20) can be written, as a result, by making transformations and replacing c by $c_0 \times [\text{m/sec}]$ in a more compact form

$$\gamma = a^{1/13} c_0^{22/39} (2\pi m_p)^{-12/13} m_e^{-1} r_e^{37/13} \times [\text{m}^{2/13} \text{sec}^{-2}], \quad (23)$$

which gives the value γ with a negligible error (here $m_p = 1836.2$).

It should be noted that the parameter r_e can be excluded from the formula for γ , since by definition it is determined by the electron mass, speed of light, dielectric constant and charge values, the latter, in turn, being determined through the electron mass, speed of light and Weinberg' angle [4].

4 Conclusion

The connection of gravity with the proton-electron contour size confirms the existence of limiting sizes, both in the microcosm and in space. So the vortex thread smallest size (the neutrino size) turned out to be equal to the Planck value \hbar [14], and the hydrogen atom largest size, still capable of radiation, corresponds to $n = 390$; this is confirmed by the fact that even in space, no excited hydrogen radio lines with $n > 301$ have been found [11]. The ratio of these limiting values makes it possible to calculate the gravitational constant.

Determining the speed of light and the gravitational constant magnitude based on the proposed physical model proves space to have the ideal fluid surface properties, where the speed of light is the surface wave speed. It has been established the ratio of forces acting in the transverse component of this wave (capillary waves) to the forces in its longitudinal component (gravitational waves) to be equal to the electric forces to gravitational forces ratio.

Thus, the original material entity is the finite thickness surface, whose deformation (fractalization) leads to the formation of material objects. Since the surface wave longitudinal component is essentially an elastic medium, in which tension-compression forces are possible, the gravity forces are the forces of attraction between material bodies, arising due to tension of this surface during its fractalization (deformation, thickening, condensation) in these bodies formation process. This is consistent with the conclusions drawn by Pierre A. Millette in his elastodynamics based on the analysis

of space-time deformation in terms of continuum mechanics [15, 16]. That is, the very *existence of material bodies is the cause of their mutual attraction*, and electromagnetic waves contain the longitudinal component, which is the gravitational waves conductor.

It has also been established that the surface wave optimal radiating cell generates radiation with the length of 1.52×10^{-3} m, which corresponds to the background radiation maximum and, therefore, may be its natural cause.

And so, on the basis of the mechanistic interpretation of Wheeler's geometrodynamics, which, not being essentially physical and mathematical, but rather physical and logical, have determined the gravitational constant value (as well as the speed of light, electron charge, neutrino mass, etc., which was stated in the relevant articles). This model's possibility to obtain and predict results not achieved by mathematized methods proves the macroanalogies underlying its full compliance with the corresponding physical natural laws, which indicates the need for further development of this model at a higher level.

Received on March 27, 2023

References

1. Dewitt B.S. Quantum gravity. *Scientific American*, December 1983, v. 249, 112–129.
2. Berera A., Buniy R. V., Kephart T. W., Päs H., and Rosa J.G. Knotty inflation and the dimensionality of spacetime. arXiv: 1508.01458, August 6, 2015.
3. Peano G. Sur une courbe, qui remplit toute une aire plane. *Mathematische Annalen*, 1890, v. 36, issue 1, 157–160.
4. Belyakov A.V. Charge of the electron, and the constants of radiation according to J.A.Wheeler's geometrodynamics model. *Progress in Physics*, 2010, v. 6, issue 4, 90–94.
5. Belyakov A.V. Macro-analogies and gravitation in the micro-world: further elaboration of Wheeler's model of geometrodynamics. *Progress in Physics*, 2012, v. 8, issue 2, 47–57.
6. Belyakov A.V. The substantive model of the proton according to J. Wheeler's geometrodynamics concept. *Progress in Physics*, 2021, v. 17, issue 1, 15–19.
7. Belyakov A.V. Nuclear power and the structure of a nucleus according to J.Wheeler's geometrodynamics concept. *Progress in Physics*, 2015, v. 11, issue 1, 89–98.
8. Belyakov A.V. Evolution of stellar objects according to J. Wheeler's geometrodynamics concept. *Progress in Physics*, 2013, v. 9, issue 1, 25–40.
9. Belyakov A.V. On the uniform dimension system. Is there the necessity for Coulomb? *Progress in Physics*, 2013, v. 9, issue 3, 142–143.
10. Belyakov A.V. On the speed of light and the continuity of physical vacuum. *Progress in Physics*, 2018, v. 14, issue 4, 211–212.
11. Pedlar A., Davies R. D., Hart L., Shaver P. A. Studies of low-frequency recombination lines from the direction of the Galactic Centre and other galactic sources. *Monthly Notices of the Royal Astronomical Society*, 1978, v. 182, issue 3, 473–488.
12. Konovalenko A. A. Decametric astrospectroscopy. *Earth and Universe*, 1986, v. 5, 26–34.
13. Tomilin A. K., Lukin A. F., Gulkov A. N. Experiment to create a radio communication channel in the marine environment. *Technical Physics Letters*, 2021, v. 47, issue 11, 48–50.

14. Belyakov A. V. Determination of the neutrino mass. *Progress in Physics*, 2016, v. 12, issue 1, 34–38.
 15. Millette P. A. Elastodynamics of the spacetime continuum. *The Abraham Zelmanov Journal*, 2012, v. 5, 221–277.
 16. Millette P. A. Elastodynamics of the Spacetime Continuum. The 2nd expanded edition, American Research Press, Rehoboth, New Mexico, 2019, 415 pages.
-