Conversation about the Nature of Gravitational Forces and the Mechanism of Long-Range Interaction

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ABSTRACT

Within the framework of this article, a modern models of the nature of gravitational forces and the mechanism of long-range interaction on the scale of the universe on the basis of a quantum space vacuum (dark matter). The effect of gravity is due to the dynamic effect of non-baryonic matter on baryonic astronomical bodies of large masses (planets and stars).

In article a number of experimental facts will be presented that cannot be explained from the standpoint of Newton's law of gravity and the of general relativity of Einstein, but can be explained within the framework of the production of gravity in the model the non-baryonic matter (represented by the analogies of the superfluid ³He-B) which is 95% of the matter in the universe, where the baryon masses constitute the remaining 5%.

Keywords: *dark matter; quantum vacuum; oscillator; gravitational funnel.*

INTRODUCTION

In his writings, Isaac Newton admitted that he could not explain the cause of the gravitational effect and the mechanism of the instantaneous action of gravitational forces between localized and remotely bodies. Newton introduced even the concept of "action-at-adistance", implying direct pairing without intermediaries in an empty universe. If the transfer of gravitational attraction occurred at a finite speed , as is customary in the field theory of short-range interaction, then due to the displacement of the planets relative to the original direction of attraction, appear additional force component along the velocity vector would. The retarded gravity of the Sun would cease to be strictly central and the planetary system would very quickly disintegrate due to the cyclic torque. Taking into account the known age of the solar system, Laplace at the beginning of the XIX century showed that the speed of propagation of gravitational forces should exceed the speed of light at least 7 000000 times [1]. In our time, this issue continues to worry the minds of scientists. Researchers of the nature of gravitacional forces can be conditionally divided into two groups - those who continue searching in the mainstream of the geometric approach that is the basis of general relativity and those

who refuse to tie the gravitational field with the geometry of space-time. The field concept of gravity [2] makes it possible to describe gravitational interactions of bodies similarly to electric and magnetic interaction and does not contradict other experimentally grounded approaches in describing the phenomenon of gravitation and inertia, in particular, to certain models involving a quantum vacuum (dark matter). In this case, gravitational fields should have properties similar to, but not identical to, the properties of electromagnetic fields [3].

THE NATURE OF GRAVITATIONAL FORCES IN MODELS QUANTUM VACUUM.

In modern models of the superfluid quantum vacuum, analogies between the properties of superfluid ³He-B and the cosmic medium (dark matter) have largely been expanded, due to the inclusion of the properties of vortices: spin and electric polarization of the medium in vortices, inertial properties of vortices, and superfluid spin currents between them [4]. A macroscopic approach, the hydrodynamic behavior (job Stokes) of the added weight of spherical bodies of any nature (including those of charged clusters) in superfluid ³He-B (analogue of dark matter) is the primary source. It is a complex

force $F(\omega)$, exerted by the fluid on the sphere of radius R, which performs oscillations with a

$$F(\omega)= 6\pi\eta R\ [1+R/\delta(\omega)]V(\omega)\ +3\pi R^2\sqrt{2\eta\rho/\omega}\ [1+2R/9\delta(\omega)]\ i\omega V(\omega), \qquad (1)$$

$$\delta(\omega) = (2\eta/\rho\omega)^{1/2}$$

where ρ - fluid density, η - the viscosity, V - velocity amplitude sphere, $\delta(\omega)$ - the so-called viscous penetration depth, which increases with an increase in viscosity and a decrease of the oscillation frequency.

The real part of the expression (1) is a known Stokes force derived from the movement of fluid in the sphere. Imaginary component (coefficient of $i\omega V$) is naturally identified with the effective mass of the cluster added:

$$Meff\ (\omega R)=2\pi\rho R^3/3\ [1+9/2\ \delta(\omega)/R] \qquad (2)$$

Origin of the added (attached) mass Meff (ωR), depending on the frequency ω and the radius R of the sphere of the cluster associated with the excitation of the field around a moving cluster of hydrodynamic velocity υ_i (r) and the appearance in connection with this additional kinetic energy. In superfluid additional mass has two components: superfluid and normal [5]. In this case, the nature of gravitational funnel, described by the speculative curvature of space-time of Einstein's general relativity, can be replaced by a gravitational funnel created in a space environment (dark matter) around rotating heavenly body of astronomical dimensions. The change in the gravitational potential occurs instantaneously in all regions of the gravitational funnel space in accordance with the pressure gradient described by Euler's-Bernoulli's equation for superfluid continuous media [6]:

$$\frac{\partial v}{\partial t} + \left(Vx\frac{\partial}{\partial x} + Vy\frac{\partial}{\partial y} + Vz\frac{\partial}{\partial z}\right)V = g - \frac{1}{\rho}\ grad\ p \quad (3)$$

This equation was established by L.Euler, 1755.

For a stationary flow without vortices, expression (3) is simplified, since in such a flow rotV at each point is equal to zero. It follows that for all flow points the motion of an incompressible fluid will be a potential [6]:

$$\frac{v^2}{2} + U + \frac{p}{\rho} = const \qquad (4)$$

where U is the gravity potential. $U = g\ z$ (z is the height).

Equation (4) is the Bernoulli's equation, 1738.

Thus, we apply Newton's second law to describe the motion in a gravitational field of particles of a medium in a small volume element dV whose density is (ρ). The mass (m=ρdV) of the volume, multiplied by its acceleration ($a = \frac{\partial v}{\partial t}$), is equal to the resultant force acting on it. The resulting force consists of gravity (ρdVg) and force arising from the difference in the value of pressure (p):

$$\rho dV\frac{\partial v}{\partial t} = \rho dVg - dV\ grad\ p \qquad (5)$$

From the equation of motion, after dividing each term (5) by ρ dV, we obtain the Euler formula (3). The potential motion of the medium in a homogeneous gravitational field will be obtained by multiplying all the terms of the Bernoulli's equation (4) by the density:

$$\rho\frac{v^2}{2} + \rho gz + p = const \qquad (6),$$

J. Kepler formulated his laws of celestial mechanics as a result of a long-term analysis of astronomical observations of Tycho Brahe in 1609 - 1619. Using Kepler's laws can determine the elliptical orbit of any planet of the solar system, or satellite and all its parameters, without attracting Newton's law of universal gravitation, and such dynamic concepts like mass, energy, force, angular momentum, and the like. Metaphysics Kepler has been further developed in the works of I. Newton and A. Einstein. Half a century after Kepler, Newton introduced forces into the spatial model of the universe. The space of the universe produces gravity and inertia forces acting following quadratic laws of interaction between bodies (laws by Coulomb and Cavendish).

Therefore Newton's law mathematically confirms long-term observations of the planets of the solar system. With his help count the positions of the planets for many years to come, but no one calculates the position of the Sun relative to the planets, since Sun is always in the center of the heliocentric coordinates. The world for this law is the planets of the solar system. For other objects of the solar system the applicability of this law is not a fact. If we try to calculate the force of attraction not between the Sun and the Earth, but between the Earth and the Sun, it becomes incomprehensible how the Earth, whose mass is negligible in relation to the Sun, can attract the Sun to itself. The Earth in orbit is held by the gravitational force of the Sun and centrifugal force, but there is no centrifugal

force the Sun with respect to the Earth. Therefore, if the Earth begins to attract the Sun to itself, then it will the Sun from collision with the Earth. From the above, we can conclude that the size of the gravitational funnel created around the Earth by vortices of an excited quantum medium (dark matter) does not reach the Sun, and the Earth falls into the region of the gravitational funnel of the Sun. Indeed, it is experimentally established that the radius of the gravitational funnel of the Earth is approximately equal to 900,000 km, and the distance from the Earth to the Sun is 150,000,000 km. This explains why the probes could not use force gravity when landing on comets and asteroids. For these bodies too weakly excite the space environment in order to create your own gravitational funnel. They fly in the solar system according to the will of the Sun and the planets, more precisely by the will of that environment in which the Sun and the planets float.

In 1899, the decisive numerous experiments by R. von Eötvös showed the equality of the inertial and gravitational masses to within 10^{-9}. Einstein raised this equality to the level of a leading postulate in his attempts to explain both electromagnetic and gravitational acceleration by the same physical laws. The equivalence principle (PE), predicts the same acceleration for bodies of different composition in the same gravitational field and allows us to consider gravity as a geometric property of space-time, which leads to the interpretation of gravity from the positions of the General Theory of Relativity [7]. Checks of the equivalence principle can be carried out by comparing the free-fall acceleration α_r of various test bodies.

The accuracy of these experiments is high enough to confirm that strong, weak and electromagnetic interactions give the same contribution to the gravitational and inert mass of the body. GRT and other metric gravity theories believe that the weak form of PE is correct, however, many extensions of the Standard Model containing macroscopic quantum fields predict a violation of the PE [8]. New theoretical models [2,3] include new types of interaction that can lead to violation of the equivalence principle, variations of fundamental constants, and violation of the Lorentz symmetry. This determines the limits of applicability of the invariant equations of Einstein's general relativity. The effect of violation of the principle of equivalence can

form the basis for creating new technologies for overcoming the force of gravity (levitation).

Next, a number of experimental facts will be presented that cannot be explained from the standpoint of Newton's law of gravity and the theory of gravity of general relativity of Einstein, but can be explained within the framework of the production of gravity in the model of the quantum medium (dark matter) in which baryonic matter only 5% of the unexplored (dark) matter of the Universe.

EXPERIMENTS

Experimental Dependence of Gravity Of Bodies and Violation of The PE on the Speed of Rotation of the Rotors and the Oscillation Frequency of Mechanical Oscillators in the Dmitriev's Experiments [9].

Unlike the "geometric" concept of A. Einstein's gravity, Professor A.L. Dmitriev adheres to the "field" concept of gravity, which allows one to describe gravitational interactions of bodies similarly to electric and magnetic interactions. In this case, gravitational fields should have properties similar to, but not identical to, the properties of electromagnetic fields. The "field" concept of gravity does not contradict other experimentally grounded approaches in describing the phenomenon of gravitation and inertia, in particular, for example, to certain models involving a quantum vacuum (dark matter). Proceeding from this, Dmitriev in his experiments considered the reaction of gravity applied to the body, on its acceleration α, caused by the action of external non-gravitational forces. Experiments were conducted to estimate the anisotropy of inertial body mass by comparing the period of natural oscillations of a linear mechanical oscillator with the vertical and horizontal orientation of its axis. In his model, describing the influence of the vertical oscillations of the test body on its average weight, Dmitriev introduced the variable in of time the value of the normal acceleration of gravity g_0 (t). The calculations show that even for small (hundredths of a percent) of the oscillations of the magnitude of the normal acceleration of the Earth's gravity, the weight of the mechanical oscillator can vary noticeably. The oscillator's weight varies periodically with frequency, and the sign and magnitude of such changes essentially depend on the phase difference Θ of the oscillator oscillations and the acceleration of gravity of the Earth. At high vibrational frequencies of the oscillator, the average weight of the oscillator is monotonously

dependent on its oscillation frequency, and the influence of phase Θ is insignificant. Such a decrease in the weight of the oscillator at high frequencies of oscillations is in good agreement with the temperature dependence of the body weight, since the frequency of thermal oscillations of micro particles of solids is very high and lies in the region of hyper sound [10]. Dmitriev conducted measurements of the instantaneous value of the free fall acceleration of a closed container with the rotor of a vacuum mechanical gyroscope fixed in it. A mechanical rotor is a system of microparticles that form a solid body moving rapidly along a circular trajectory. The radius of the rotor used in the experiment is R = 140 mm.

At frequencies of the oscillator tens of times higher than the natural frequency of the normal gravity acceleration F = 600 Hz, the monotonic frequency dependence of the variation Δg of the average value of the free-fall acceleration is fulfilled, the sign of Δg being directly determined by the phase difference Θ of oscillations, the acceleration of gravity of the Earth and oscillator. Both a significant increase and a decrease in the average gravity acting on the mechanical oscillator from the side of the Earth's alternating gravitational field are possible. Professor AL Dmitriev believes that independent measurements of the high-frequency (the range of hundreds-thousands of Hz) spectra of fluctuations in the acceleration of gravity of the Earth, performed using superconducting gravimeters, will allow us to determine the regimes of matched oscillations of the oscillator, in which changes in its average weight can cause levitation or , on the contrary, a sharp increase in weight.

This effect can be the basis for the creation of technical systems to overcome the force of gravity and a new principle of controlling the motion of bodies [11]. In this regard, I want to recall the historically reliable facts of the levitation of the Italian monk Giuseppe Desa (1603-1663) and the nun from Avila. Falling into religious ecstasy, both of them repeatedly against their will broke away from the Earth and hovered at an altitude of several meters and above. At the same time, their bodies vibrated with a certain frequency representing an analog of a physical oscillator. Here I would like to note that the same effect today can cause technogenic catastrophes. A similar accident occurred on August 17, 2009 at the Sayano-Shushenskaya hydroelectric power station. The turbine of the second hydroelectric unit

suddenly began to rotate at a hypersonic speed, which led to the destruction of the fixing bolts, the destruction of the room and the death of 75 people.

Experimental Data of Gravimeters

A large number of experimental data on the gravity of the Earth performed using superconducting gravimeters. Experiments with gravimeters in deep mines show that gravity does not depend not only on local differences in the distribution of masses on the Earth's surface, but the entire mass of the Earth has an indirect connection with the production of terrestrial gravity through the excitation of the cosmic medium [12].

Calculation of the Motion of the Perihelion of Mercury and the Einstein's Error

The theory is completely useless if it is not confirmed by experiment. From the time of Einstein to verify the reliability of the theory of gravity, the calculation of the motion of the perihelion of Mercury was used. It has long been known in astronomy that because of its proximity to the Sun and under the influence of the gravity of other planets, Mercury is moving not just along an ellipse, but an ellipse which itself slowly rotates in 575" within a hundred years. This is an abnormal precession for the planets of the solar system. The corrections calculated on the basis of Newton's theory gave a rotation of the perihelion 532". It is believed that the remaining value of 43"cannot be explained within the framework of Newton's theory. In 1915 A.Einstein calculated the precession of the perihelion of the orbit of Mercury and obtained the expected value 43", using the field equations of general relativity [7], it became his triumph. However, in 2013 it turned out that Einstein made a mistake in his calculations. In the United States and China, in 2013, a joint collection of "Unsolved Problems in Special and General Relativity" [13], Chief Editor Prof. Florentin Smarandach USA which can be called the Requiem for the Special and General Theories of Relativity. It contains 21 articles, one of them from the United States and one from Russia, and the rest from China. The collection opens with an article by Chinese mathematician Academician Hua Di "The explanation of the motion of the perihelion of Mercury by Einstein" [13, p. 5]. Academician Hua Di showed that, in calculating the precession of the perihelion of the orbit of Mercury, Einstein made a gross error in the evaluation of the integral. As a result, the result

was 71.5", and not 43". In this story, it is alarming that in some later editions of Einstein's paper in formula (3) before the integral, the coefficient 0.5 appears in square brackets in front of the integral and the result of the calculations becomes closer to 43".

The Practice of Interplanetary Spacecraft Flights

The practice of interplanetary flights shows that in the solar system the zone of action on the spacecraft of gravity of the Sun and the gravity of each of the planets have their boundaries. Planetary gravitational funnels are finite in size and do not overlap. At the moment when the space vehicle crosses the boundaries of these regions, the "true" speed of the apparatus changes abruptly. Moreover, for the correct calculation of interplanetary flight, the "true" speed of the device within the planetary gravitational funnel should be counted only in the planet-centric reference system, and in interplanetary space - only in the heliocentric frame of reference. The effect of a sudden change in the speed of a spacecraft (up to tens of kilometers per second) upon entering a gravitational funnel of Mars or Venus is a real and experimentally confirmed fact [14]. The consequence of this jump is an unforeseen Doppler shift of the carrier frequency during radio communication with the apparatus and a change in the type of its trajectory of motion. For this reason, a number of Soviet and American vehicles were lost during the first flights to Venus and Mars. The fact of the separation of gravitational planetary funnels naturally follows from the gravitation hypothesis, which is based on the excitation of the cosmic medium (dark matter) by astronomical bodies.

Anomalous Gravitation of the Moon

The first flights on Russian and American space vehicles in near-moon space showed that the region of lunar gravity captures a distance of about 10000 km from the surface of the Moon [14].

For comparison, the radius of the gravitational funnel of the Earth is about 900,000 km. Thus, with the distance between the centers of the Earth and the Moon, R = 384 467 km, lunar gravity cannot reach the surface of the Earth. If the lunar gravity does not reach the Earth, then the Earth should not have a dynamic response to the Moon, that is, the Earth should not move taking into account the common center of mass of the Earth-Moon. So it really is. The earth

with its orbital motion around the Sun performs only one-dimensional oscillations back and forth - with a period in the synodic month. If there was a common center of mass, the Earth would perform similar oscillations from right to left, If there was a common center of mass, the Earth would perform such oscillations from right to left, that is not only along the current section of its orbit, but also transverse oscillations-with an amplitude deviation of about 4670 km! However, the most accurate methods of measurements in the Doppler spectroscopy of the Sun and the radio location of the planets they could not detect transverse oscillations of the earth in orbit. Taking into account that the Moon writes out a two-dimensional curve near the conditional center, and the Earth performs one-dimensional oscillations around this center, gives a purely geometric explanation of one of the main inequalities in the motion of the Moon-**variations**. Of course, one-dimensional synodic oscillations of the Earth "forward-backward" are not generated by the action of the moon. The gravitational funnel of the Earth, in which the Moon moves, itself moves in the gravitational funnel of the Sun. This determines the synodic modulation of the Earth's orbital velocity, at which the resulting periodic impact on the moon synchronizes its orbits around the Earth. The impact is due to the fact that acceleration of the gravitational funnel of the Earth generates the reverse acceleration of bodies located in its inertial space, which leads to perturbation in the motion of these bodies. Hence follows the explanation of yet another major inequality in the motion of the Moon – **ejection.** Inertial bias should disturb the movement not only of the Moon, but also of artificial Earth satellites. This is confirmed for GPS satellites. The parameters of their orbits, according to the official data of the NORAD system, experience sidereal variations, the cause of which in no way to perturbations on the part of the Moon and remains a mystery in the framework of the traditional approach.

Finally, the question arises, since the gravity of the Moon does not affect the surface of the Earth because of its remoteness, what causes the tides in the oceans. The dynamics of tides coincides with the phases of the Moon, since the true cause of the tides are the synodic oscillations of the gravitational funnel of the Earth, which also control the movement of the Moon. At the water surface of the world ocean, local gravity

vectors are set orthogonally to the local vertical, but because of the diurnal rotation of the Earth, rotational deviations are experienced. Russian physicist A.A. Grishaev carried out a direct detection of diurnal rotational deviations of vertical lines- http://newfiz.narod.ru/inclin1.htm . The world ocean is split into adjacent areas, with a typical size of several thousand kilometers, in each of which autonomously occurs the birth of tidal waves. This is the essence of tidal phenomena - and there is no global tidal ellipsoid, with two humps, in the World Ocean. In tide-generating exposures of the gravitational funnel of the Earth, the period is not a semi daily one, but a daily one, which is directly confirmed by gravimetric measurements. Semi daily tides that occur not in open oceans, but near coasts, are the result of excitation of the second harmonic of a rotating wave - daily exposure.

CONCLUSION

Thus, with the advent of the era of space flights and new sophisticated instruments for observing the universe, the data of space experiments came into conflict with the prevailing Newton's Universal Law of Gravitation and Einstein's general theory of relativity. The spread of these laws to the entire universe encounters their violation, in of the motion of stars and galaxies. Moreover, the laws of gravity are not fulfilled in flights of space vehicles to asteroids and comets visiting the solar system. Laws are fulfilled only for the planets of the solar system, for which they were created by Kepler, after analyzing the astronomical observations of Tycho Brahe. The universal law of gravitation still awaits its embodiment after solving the main question - the nature of gravitation. Within the framework of this article, a possible model of gravitation in the scale of the universe was proposed, including the effect of non-baryonic matter of the space medium on baryonic bodies, of astronomical masses, the nature effect analogous to the hydrodynamic effect on the bodies in a continuous medium (Stokes law).The physical nature of gravitation in the Universe is due to the excitation of dark matter and dark energy which makes up 95% of the matter in the Universe, wherein baryon masses of constitute the remaining 5% [15].

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