GRAVITY MODEL WITH NEUTRINO-LIKE PARTICLES

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The dynamics of a two-body system in an isotropic radiation medium is considered. Newton's gravitational equations were obtained under the condition that the radiation carriers are neutrino-like particles. The existence of a common particle in the mechanisms of gravitational and weak interactions is proposed.

The experimentally observed correlation between a speed of beta-decay of nuclei S-32 and Cl-36 and the gravitational-wave splash the GW 170817 [1] can be interpreted as the possibility of the participation of neutrinos (or particles similar to them) in the mechanism of the gravitational interaction.

The model of gravitation, containing gravitons – hypothetic particles with a spin 2 – was proposed long ago. However, quanta of the gravitational interaction still have not been registered experimentally. On the other hand, neutrinos, whose characteristics have been studied rather well, are registered only as a result of indirect measurements.

Assume that the gravitons are some type of neutrino, hardly registered particles with an extremely small cross section.

Lets consider a three-dimensional Euclidean space, filled with isotropic eradiaton, which carries are the mentioned neutrinos. When neutrinos are absorbed or scattered by massive particles, a force that acts on these particles arises. The magnitude of the force F, acting on a massive particle in the direction **n**, is proportional to the number of neutrinos Δn, passing through its section σ with the normal **n** in unit of time $\Delta\tau$

$$F = \sigma \frac{\Delta n}{\Delta \tau} p \,. \tag{1}$$

p – a value of impulse, transmitted to the massive particle while absorbing or scattering of neutrino-like particles (further, neutrino).

Thus, far from other bodies the particle is in equilibrium, as the neutrino flux is isotropic. In the presence of other particles the equilibrium is disturbed. This is due to the growing deficit of neutrinos, coming from the other particles. Let the value of the specific angular intensity of the neutrino flux (per unit of the surface area), coming from the external boundaries, be equal to ń. In this case the magnitude of the neutrino flux deficit on the part of another particle will be equal to:

$$\Delta \dot{n} = 4\pi \dot{n} \frac{\sigma_2}{4\pi R^2}, \tag{2}$$

R – the distance between the particles, σ_2 – the section of the second particle in the process of the neutrino scattering (absorption). The condition of the observance of the equation (2) is worth of a especial noting. The square of the distance between the particles must exceed significantly their cross sections:

$$4\pi R^2 \gg \sigma_2. \tag{3}$$

The lack of the neutrino flux from the second particle causes the growth of the force, acting on the first particle in the direction to the second one. The force amount, due to (1), is proportional to the section of the first particle σ_1 and equals:

$$F = \dot{n}p \frac{\sigma_1 \sigma_2}{R^2}. \tag{4}$$

It is worth noting that the same consideration can be applied to the second particle with respect to the first one. We will obtain the same force (4), acting on the second particle towards the first.

Equating the force (4) to the Newton gravitational force, we'll get:

$$\gamma m_1 m_2 = \sigma_1 \sigma_2 \dot{n}p, \tag{5}$$

where γ is a gravitational constant. From here we can get a value of specific section of the massive particles in the process of the neutrino scattering absorption:

$$\frac{\sigma}{m} = \sqrt{\frac{\gamma}{\dot{n}p}}. \tag{6}$$

The formula (6) is correct, if the values of specific sections for different particles are identical. Assume that it is and estimate the value of a specific section in the named process. In order to do it, consider a particle in the Earth's gravitational field near its surface. In this case the condition (3) is:

$$4\pi R_{\oplus}^2 \gg \sigma_{\oplus} = \frac{\sigma}{m} M_{\oplus}, \qquad (7)$$

where $R_{\oplus}$ – a radius, $m_{\oplus}$ – a mass, $\sigma_{\oplus}$ – a total section of the Earth's particles. The calculation demonstrates that the specific section of particles (atoms), forming the Earth, in the process of the neutrino scattering (absorption), is considerably less 10^{-11}m^2/kg. In order of magnitude, this corresponds to a section of the process of coherent neutrino scattering on nuclei [2]. According to the maximum specific section of the particles (atoms), you can determine the minimum value of the neutrino flux density – a product *ńp*. According to the formula (6), this value corresponds to 10^{12}Pa.

With regard to the choice between scattering or absorption of neutrinos in the process of interaction, the scattering seems more preferable. It is clear that with this mechanism, the spin of the particles remains unchanged.

Thus, the proposed elementary model allows us to establish commonality in the processes of gravitational and weak interactions through a single particle, the neutrino, which participates in the mechanisms of both interactions. This can explain the simultaneous decrease and the following increase in the decay rates of Si-32 and Cl-36 after the gravitational-wave splash the GW 170817, caused by the merging of binary neutron star.

References:

1. http://arxiv.org/abs/1801.03585
2. Bednyakov V. A., Naumov D. V. and Smirnov O. Yu. Physics-Uspekhi, Vol. 59, 2016, N 3, p. 225