The Balance of Gravitational Potentials

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Abstract. The gravitational state of a particle (body) is characterized by four parameters of the gravitational potentials of the medium inside the quantized space-time. We have: the gravitational potential of undeformed quantized space-time; the gravitational action potential of deformed quantized space-time outside of the particle (body); the gravitational potential of deformed quantized space-time inside a particle (body); the Newton potential of the quantized space-time. This is a fundamentally new method of gravitational analysis based on the quantum theory of gravity. The balance of the gravitational potentials of the gravitational field of a particle (body) inside the deformed quantized space-time is a constant. [1-8].

Keywords: balance, gravitational potentials, normalized relativistic factor.

The gravitational state of a particle (body) is characterized by four parameters of the quantum density of the medium inside the quantized space-time [1, 2]:

$$\rho_o,\ \rho_1,\ \rho_2,\ \rho_n \qquad (1)$$

where ρ_o is quantum density of undeformed quantized space-time, q/m^3;

ρ_1 is quantum density of deformed quantized space-time outside of the particle (body), q/m^3;

ρ_2 is quantum density of deformed quantized space-time inside a particle (body), q/m^3;

ρ_n is imaginary quantum density of the quantized space-time, q/m^3;

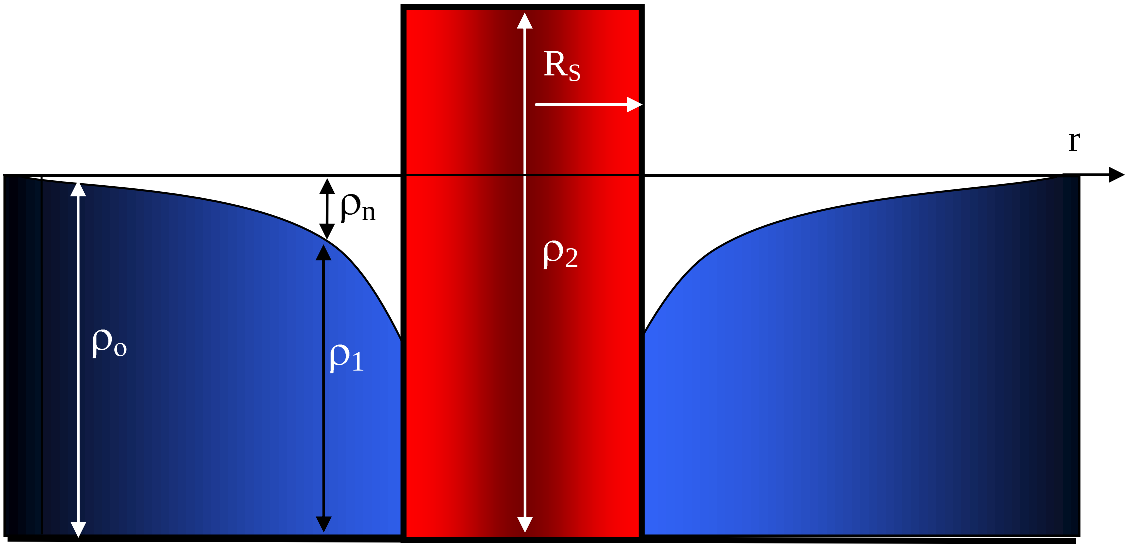

Fig. 1. **G**ravitational diagram of the distribution of the quantum density of the medium (ρ_1, ρ_2, ρ_0, ρ_n) of the particle (body); ρ_2 is the region of compression of the medium, ρ_1 is the region of stretching of the medium.

Figure 1 shows **g**ravitational diagram of the distribution of the quantum density of the medium (ρ_1, ρ_2, ρ_0, ρ_n) of the particle (body). The region of stretching of the medium is ρ_1 = f (r), where r is the radius. The region of compression of the medium is ρ_2.

In [1, 2], we found the balance of the quantum density of the medium of a particle (body) inside a gravitational well (Fig. 1):

In statics:

$$\rho_o = \rho_1 + \rho_n = \text{Const} \tag{2}$$

In dynamics:

$$\rho_o = \rho_1 + \gamma_n \rho_n = \text{Const} \tag{3}$$

where γ_n is the normalized relativistic factor [x]:

In (2), we introduced the normalized relativistic factor γ_n [3]:

$$\gamma_n = \frac{1}{\sqrt{1 - \left(1 - \frac{R_g^2}{R_S^2}\right)\frac{v^2}{C_o^2}}} \tag{4}$$

where C_o^2 = 9·10^{16} J/kg is gravitational potential of undeformed quantized space-time;

v is particle speed, m/s;

R_S is radius of the gravitational boundery (the interface) between the regions of tension and compression (radius of the particle, body), m;

r is distance, m;

R_g is gravitational radius (without multiplier 2), m:

$$R_g = \frac{Gm}{C_o^2} \tag{5}$$

where G = 6.67·10^{-11} Nm^2/kg^2 is gravitational constant;

m is mass, kg;

The quantum density of the medium is an analogue of the gravitational potential [4]:

$$k_\varphi = \frac{\rho_o}{C_o^2} = \frac{\rho_1}{C^2} = \frac{\rho_n}{\varphi_n} = \frac{\rho_2}{\varphi_2} = 4 \cdot 10^{58} \frac{q}{J}\frac{kg}{m^3} = \text{const} \tag{6}$$

The conversion coefficient k_φ (6) of the quantum density of the medium and gravitational potentials is a constant:

$$k_\varphi = \frac{\rho_o}{C_o^2} = 4 \cdot 10^{58} \frac{q}{J}\frac{kg}{m^3} = \text{const} \tag{7}$$

where $\varphi_o = C_o^2$ is gravitational potential of undeformed quantized space-time, J/kg;

$\varphi_1 = C^2$ is gravitational action potential of deformed quantized space-time outside of the particle (body), J/kg;

φ_2 is gravitational potential of deformed quantized space-time inside a particle (body), J/kg;

φ_n is Newton potential of the quantized space-time, J/kg:

$$\varphi_n = \frac{Gm}{r} \quad (8)$$

where r is distance, m.

From (2) and) 3), taking into account (6), we find the balance of gravitational potentials inside the gravitational well:

In statics:

$$\varphi_o = \varphi_1 + \varphi_n = Const \quad (9)$$

Or: $$C_o^2 = C^2 + \varphi_n = Const \quad (10)$$

In dynamics:

$$\varphi_o = \varphi_1 + \gamma_n \varphi_n = Const \quad (11)$$

Or: $$C_o^2 = C^2 + \gamma_n \varphi_n = Const \quad (12)$$

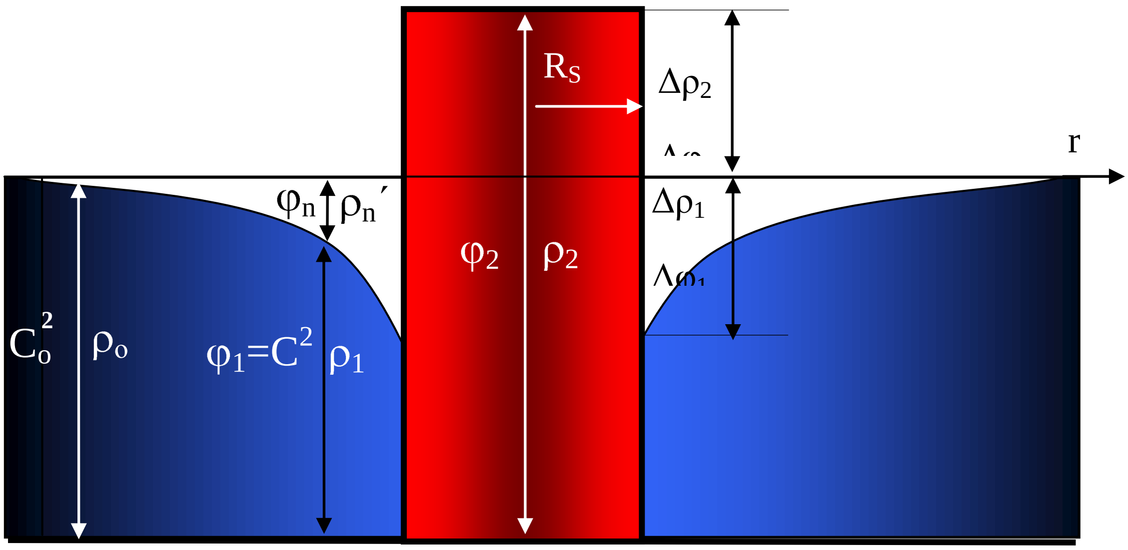

Fig. 2. Gravitational diagram of the distribution of the quantum density of the medium (ρ_1, ρ_2) and gravitational potentials (φ_1, φ_2) of the nucleon; ρ_2 is the region of compression of the medium, ρ_1 is the region of stretching of the medium.

The implementation of balance (9)-(12) we see on the **g**ravitational diagram (Fig.1) [1-7].

In the region of relativistic speeds, we observe a decrease in the quantum density of the medium and the gravitational action potential around the particle (body) and the formation of a deeper gravitational well. Inside a particle (body) we observe an increase in the quantum density of the medium. Upon reaching the speed of light, the particle has the state of a black micro-hole. In this case, we will see that inside of the particle the quantum density doubles, and outside it there is a drop in the quantum density to zero [1-10].

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