Gravitational Diagram of a Non-Ideal Black Hole

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Abstract. In [1], we examined the parameters and properties of an ideal black hole. The ideal black holes characterized discontinuities of the quantized space-time on the surface of the black hole. Its formation is completed. Such a black hole is completely invisible. Non-ideal black holes do not have discontinuities of quantized space-time on the surface of a black hole. Its formation is not completed. Such a black hole has a visible glow due to the reflection of photons from its surface. We describe the state of a black hole by a system of equations in the form of a two-component solution of the Poisson equation for the quantum density of the medium and gravitational potentials. An analysis of the spherical deformation of quantized space-time allows us to look inside a black hole and describe its external gravitational field.

Keywords: black hole, ideal black holes, non-ideal black holes, quantum density, gravitational compression, deformation vector, gravitational forces.

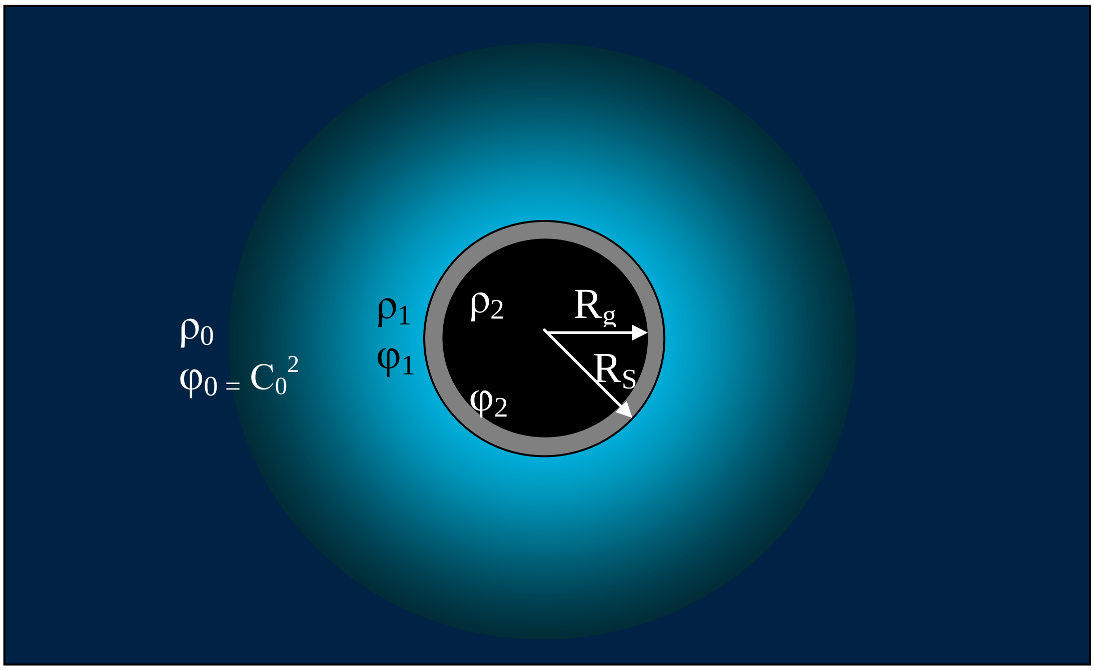

Fig. 1. A non-ideal black hole inside quantized space-time.

ρ_1, φ_1 is the region of expansion (blue); ρ_2, φ_2 is the region of compression (black);

Figure 1 shows a non-ideal black hole inside quantized space-time. The process of its formation is incomplete. A non-ideal black hole has a radius R_S of its surface slightly larger than its gravitational radius R_g:

$$R_g = k_g R_S \tag{1}$$

where k_g is the coefficient of incompleteness of the collapse.

Radius R_S is of the gravitational boundery (the interface) between the regions of tension and compression.

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

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

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

m is mass, kg;

$C_o^2 = 9 \cdot 10^{16}$ J/kg is gravitational potential of undeformed quantized space-time.

We describe the state of a black hole by a system of equations in the form of a two-component solution of the Poisson equation for the quantum density of the medium and gravitational potentials:

$$\mathrm{div}(\mathrm{grad}\rho) = k_o \rho_m \tag{3}$$

where k_0 is the proportionality coefficient,

ρ_m is the density of matter, kg/m^3.

The Poisson equation (3) has a two-component solution in the form of a system of equations for the regions of gravitational extension ρ_1 and compression ρ_2 of quantized space-time as a result of its spherical deformation during the formation of the mass of a particle (body) [2-7]:

$$\begin{cases} \rho_1 = \rho_o \left(1 - \frac{R_g}{r}\right) \text{ at } r \geq R_S \\ \rho_2 = \rho_o \left(1 + \frac{R_g}{R_S}\right) \end{cases} \tag{4}$$

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

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;

We write the classical Poisson equation for gravitational potentials φ:

$$\mathrm{div}(\mathrm{grad}\varphi) = 4\pi G \rho_m \tag{5}$$

None of the physicists before could find a two-component solution of the Poisson equation (5) for gravitational potentials by analogy with the solution for the quantum density of the medium. Now, by analogy with solution (4), we can write a two-component solution of the Poisson equation (5) for gravitational potentials:

$$\begin{cases} \varphi_1 = C^2 = C_o^2\left(1 - \dfrac{R_g}{r}\right) \text{ при } r \geq R_S \\ \varphi_2 = C_o^2\left(1 + \dfrac{R_g}{R_S}\right) \end{cases} \tag{6}$$

where φ_1 and φ_2 are the distribution functions of the gravitation potential for the spherically deformed space-time, J/kg.

From (4) and (6), taking into account (1), we write down the parameters of the ideal black hole on its surface at $R_g = k_g R_S$ (1):

$$\begin{cases} \rho_{1S} = \rho_o(1 - k_g) \\ \rho_2 = \rho_o(1 + k_g) \end{cases} \tag{7}$$

$$\begin{cases} \varphi_{1S} = C_S^2 = C_o^2(1 - k_g) \\ \varphi_2 = C_o^2(1 + k_g) \end{cases} \tag{8}$$

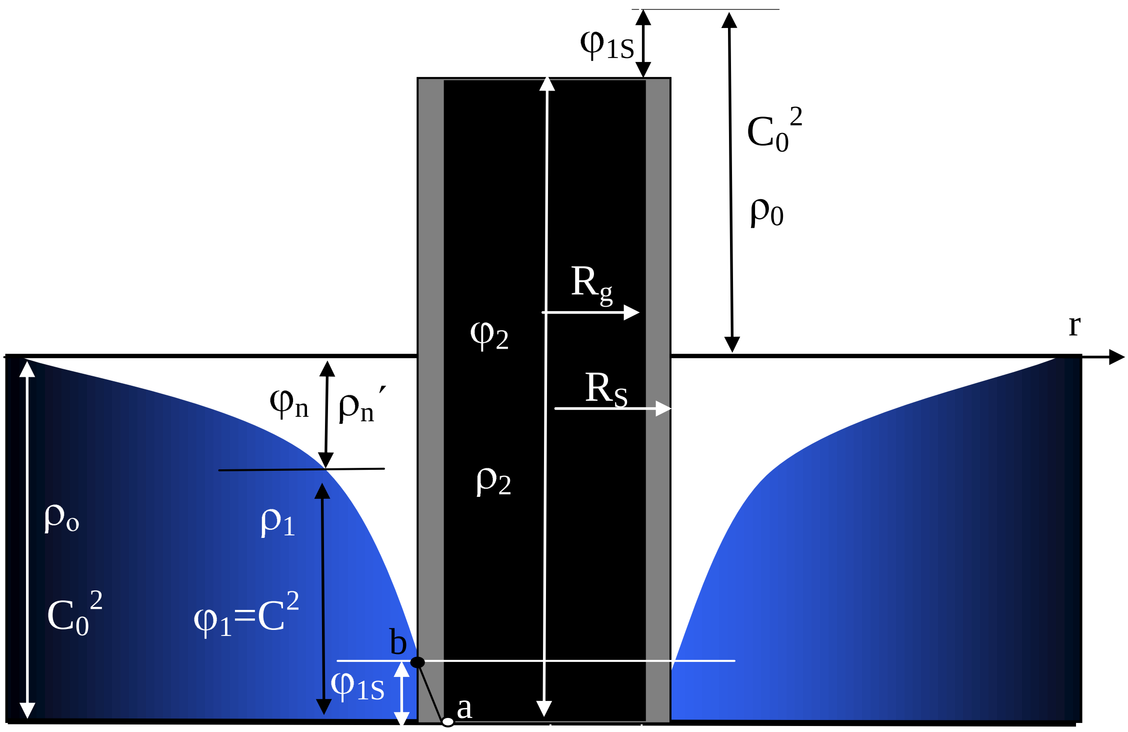

Fig. 2. Gravitational diagram of a non-ideal black hole.

Figure 2 shows gravitational diagram a non-ideal black hole inside quantized space-time. A black hole is formed as a result of the collapse of matter and compression of quantized space-time. The process of forming a non-ileal black hole is not complete. We calculated the parameters of a non-ideal black hole using formulas (4), (6), (7), (8).

We write the gravitational potential φ_{1S} on the surface R_S of a black hole in region b from (8):

$$\varphi_{1S} = C_S^2 = C_o^2(1 - k_g) \quad (9)$$

The speed of light C on the surface of a black hole is found from (9):

$$C = C_o\sqrt{1 - k_g} \quad (10)$$

Specifically, from (10) we obtain the speed of light at k_g=0.5 (1):

$$C = C_o\sqrt{0.5} = 0.7C_o \quad (11)$$

Non-ideal black hole does not have a discontinuous quantum density ρ_{1S} (7) of the medium on the surface and she can radiate light (Fig. 2):

$$\rho_{1S} = \rho_o(1 - k_g) \quad (12)$$

As we see from (11) and (12), on the surface of a non-ideal black hole the light does not stop and has a real speed. The surface of the black hole is a mirror. It is not experimentally proven that a photon has mass. A photon has no mass and should not be exposed to strong gravity. The deviation of the photon trajectory is associated with the deformation (curvature) of the quantized space-time by gravity. But photon is not subjected to direct pull of gravity. Therefore, non-ideal black holes are capable of reflecting light from its surface and its luminosity. The decay of matter into quarks on the surface of a non-ideal black hole may be accompanied by radiation as well. Given the polar phenomena, the direction of such radiation can be special. And in this case, by the way, one can recall the Hawking radiation [8, 9].

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