Gravitational Spacetime Black Holes

Sylwester Kornowski

Abstract: We are considering here whether compression of Einstein's spacetime can contribute to the creation of spacetime black holes. The Scale-Symmetric Theory shows that the scenarios describing fate of a neutron star with an endoparasitic black hole must be verified.

1. Introduction

It is amazing that the masses of two gravitational spacetime black holes calculated here ($0.7 \cdot 10^{-8}$ [solar mass] and $2.3 \cdot 10^{-2}$ [solar mass]) are consistent with the masses appearing in the solution of the Einstein equations coupled to hydrodynamics for neutron star consumed by the endoparasitic black hole: $\sim 10^{-8}$ [solar mass] and $\sim 10^{-2}$ [solar mass]) [1]. In [1], it is suggested that when a small seed black hole (BH) in the centre of a rotating neutron star grows then ultimately the BH consumes the star. The lower limit for such process is a BH seed with mass $<\sim 10^{-8}$ [solar mass]. A rapid evolution occurs after the BH reaches mass $>\sim 10^{-2}$ [solar mass].

From the characteristics of the BH described below it follows that we need to modify the scenario of transforming a neutron star into a black hole – in fact, the neutron star transforms into the neutron black hole (NBH) [2]. Such processes may have occurred as a result of the collision of neutron stars near massive black holes in the centres of primordial galaxies. It was these processes that could decrease the number density of the pulsars, turning them into silent NBHs, i.e. NBHs without an accretion disc.

2. Calculations of radii and masses of the gravitational spacetime black holes

According to the Scale-Symmetric Theory (SST) [3], the core of baryons is the black hole for the nuclear strong interactions while the central condensate in centre of baryons (and muons) is the black hole for the weak interactions.

The weak black hole in centre of the baryons arises due to the compression of the Einstein spacetime which consists of the neutrino-antineutrino pairs. The excess density of the compressed Einstein spacetime is determined by the effective radius of the neutrinos [4]. The calculated excess density, $\rho_{Depolarized}$, is 40,362.942 times lower than the mean density [2]

$$\rho_{Depolarized} = 2.7307 \cdot 10^{23} \text{ kg/m}^3 . \quad (1)$$

Such condensates we will call the depolarized condensates because the unitary spins of the neutrino-antineutrino pairs are not polarized. The depolarized condensates are unstable because on their surface the gravitational pressure is much lower than the dynamic pressure.

Due to the shortest-distance quantum entanglement, there can appear condensates with much higher density and polarised spins of the neutrino-antineutrino pairs. The distance between neutrinos in the direction of their spin is $2\pi/3$ times higher than the equatorial radius of the core of neutrinos while in the directions perpendicular to the spin is 2π times higher [3]. It leads to the density, ρ_{Spin}, of such condensate

$$\rho_{Spin} = 3\ M_{Neutrino} / (2\ \pi\ R_{Neutrino})^3 = 2.8828 \cdot 10^{36}\ kg/m^3\ , \qquad (2)$$

where $M_{Neutrino} = 3.3349306 \cdot 10^{-67}$ kg is the lowest mass of non-rotating-spin neutrino, and $R_{Neutrino} = 1.1184555 \cdot 10^{-35}$ m is the equatorial radius of the core of lightest neutrinos [3].

The condensates with density equal to ρ_{Spin} (we will call them the spin condensates) are moving with the speed of light in vacuum c and they should be much stable than the depolarized condensates.

A gravitational physical black hole must have a surface with a radius, R_{PBH}, defined as follows

$$R_{PBH} = G\ M_{PBH} / c^2 = G\ 4\ \pi\ R_{PBH}^3\ \rho / (3\ c^2)\ , \qquad (3a)$$

i.e.

$$R_{PBH} = c / (G\ 4\ \pi\ \rho / 3)^{1/2}\ , \qquad (3b)$$

where G is the gravitational constant (it is derived in [3] from the initial parameters applied in SST).

Mass of such black hole, M_{PBH}, we can calculate from formula

$$M_{PBH} = R_{PBH}\ c^2 / G\ . \qquad (4)$$

Using the densities for the spin condensate and depolarized condensate we get the radii and masses of the spin and depolarized spacetime black holes

$$R_{PBH,Spin} = 1.056 \cdot 10^{-5}\ m\ , \qquad (5a)$$

$$M_{PBH,Spin} = 1.422 \cdot 10^{22}\ kg = 0.715 \cdot 10^{-8}\ [\text{solar mass}]\ , \qquad (5b)$$

$$R_{PBH,Depolarized} = 34.312\ m\ , \qquad (6a)$$

$$M_{PBH,Depolarized} = 4.621 \cdot 10^{28}\ kg = 2.323 \cdot 10^{-2}\ [\text{solar mass}]\ . \qquad (6b)$$

3. The mechanism of growth of neutron stars

SST shows that relativistic mass appears when we accelerate a particle containing one or more the tori/electric-charges [3]. It means that the spin black hole, which is moving with the speed c, has no relativistic mass.

In regions with very high number density of the neutron stars, due to their collisions, because of the very high surface density of the tori/electric-charges in the core of baryons, there can be created the spin PBHs. Such surface density is about 300,000 times higher than the surface density in the Einstein's spacetime. The high surface density causes that rotating neutron stars and neutron black holes have the spherical symmetry because the angular momentums of both neutron star and the Einstein's spacetime inside it are the same i.e. the rotating star is in the rest in relation to rotating spacetime. The very frequent collisions of the spin PBHs with a neutron star can create the depolarized PBHs inside it what accelerates the formation of a baryon accretion disc and causes a rapid increase in mass of the neutron star.

According to SST, there is the upper limit on the mass of the neutron star (24.81 [solar mass] [2]) at which it becomes the neutron black hole.

When the accretion disc disappears, the neutron black hole becomes invisible. I am convinced that the silent massive black holes in centres of galaxies consist of such silent neutron black holes.

References

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