A Possible Evolution of Black Holes by Using a Hydrodynamic Analogy

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Abstract: *The creation of black holes starts with the implosion of a star after the fuel to power the thermonuclear reactions from inside was consumed. Then more and more mass is added until a critical value of the ratio mass/radius was obtained. This ratio contains the Schwarzschild radius, the general relativity being taken in consideration as well. Mainly, the definition of the black hole implies the impossibility of light to leave the black hole/ Essentially, the definition of a black hole implies that light cannot leave the black hole. In this paper, we show that the inability of HD-gravitons to leave a black holes will affect the black hole evolution. In this paper, we show that the inability of HD gravitons to leave a black hole will affect the evolution of the black hole.*

Key Words: *Schwarzschild radius, HD-graviton, particle creation*

1. INTRODUCTION

The black hole formation takes place for a sufficiently large ratio of its mass to its radius, considering spheres. This critical ratio is deduced bellow for spherical bodies.

2. DEDUCING THE MAIN FORMULA FOR BLACK HOLE FORMATION

The required/ necessary relationship will be obtained in the following [1, 2, 3, 4]. First some general considerations are made.

From Table 1, it can be seen that a number of parts, N_P, large enough for various situations to occur, should be taken of mass M_P.

One of them could be the ***black holes formation*** as a consequence of the mass concentration.

The main condition for the definition of a black hole is the impossibility to emit photons [5]. Obviously, there is an analogy with the second cosmic speed when launching satellites from Earth. Further, here we have R_U, a radius of the Universe (smaller than the actual/real one), n is the refraction index, related to the general theory of relativity.

Table 1. Some regional characteristics for R_U= 0.915 E10 l.ys.

M_P, kg	N_P	R_P, l.ys./meter	R_{crit}, m	M_P/R_{crit}	(n-1). $E6$
2E30	1.288E23	1.119E2/ 1.099E18	6.955 E8	2.876 E21	4.00
2E42	1.288E11	1.119 E6/ 1.099E22	1.314 E22	1.425 E20	0.211
7.894E36	3.947E6	7.318E-9/ 0.6923E8	1.170E10	6.747 E26	Black hole

Then, denoting by E_{ph} the energy of a photon at the black hole frontier of the radius R_{Bh} and using the expression of the gravity force given by the general relativity for photon and also considering the mechanical work of this force from R_{crit} to infinity, one obtains the condition:

$$E_{ph} \leq 2\frac{f_N M_P}{R_{Bh}}\frac{E_{ph}}{c^2}; \frac{M_P}{R_{Bh}} \geq \frac{c^2}{2f_N(t_U)}; \quad \left(M_P/R_{Bh}\right)_{crit} = 6.747E26 \tag{1}$$

Thus, ***a critical value for the ratio*** $M_P/R_{Bh} = (M_P/R_{Bh})_{crit}$ for the black hole formation is obtained. According to Newton's formula, this ratio is only half therefore, the general relativity effects help to form the black hole (factor "2"in relation (1)).

The dependence $f_N(t_U)$ of the gravity coefficient on the age of the Universe is also to be considered. As the gravity coefficient decreases with time, the critical ratio $\left(M_P/R_{Bh}\right)_{crit}$ increases with time. The critical radius is the largest radius for a given mass to form a black hole. The refraction index at the critical black hole frontier is n_{Bh}=$e^1 = 2.718$.

Of course, black holes of higher densities can be formed at smaller values of the frontier radii, the refraction index increasing exponentially. A suggestion can be made with respect to so- called ***dark matter.***

This could be given by/due to black hole formations close to the actual critical value 6.747E26 kg/m; thus the black hole is weak, not able to act visible to surroundings; in addition at such a body surface the speed of a coming photon is sensibly reduced due to the big values of the refraction index.

From Table 1 it results that both the Sun-like model and the Galaxy model shown, comparing the M_P/R ratios, are currently far from a state of black hole. The same behavior has a Sun- like body within a Galaxy: M_P/R = 1.522E18 *Kg/ m.*

In the last line of Table 1 the characteristics of a black hole made from 3.947E6 Sun masses at the limit for a black hole formation are given. Such a mass would correspond to a super-massive black hole that is thought to exist at the center/ centre of our Galaxy.

Calculations suggest a possible multi-stage formation of a black hole, with the cluster eventually being concentrated to form a final powerful black hole.

This results in a black hole similar to the one thought to exist at the center centre of our Galaxy (named ***Sagittarius*** *A*, with a radius 31.6 times that of the Sun and a mass about 4.1 million times that of the Sun.)

Another black hole recently discovered in the Virgo galaxy is M87, with a mass two thousand times larger than ***Sagittarius*** *A.*

As for dark energy in the Universe, it can be assimilated to the HD-gravitons energy, E_{gU}, given in [3], according to our hydrodynamic model of gravity.

Is the Universe a black hole? The ratio M_P / R_S for the actual Universe is 2.632E27 kg/m, a value exceeding the critical value for black hole formation (1). In the earlier stages this value was larger. **However, the Universe cannot be considered a black hole as it is in expansion with the speed of the frontier photons equal to the limit speed.** Nothing comes out of the edge of the Universe anyway.

3. EVOLUTION OF THE BLACK HOLE. POSSIBLE PARTICLE CREATION

In Fig. 1 the actual energy and matter distribution in Universe are given. The dark energy is considered in our HD analogy as formed from the HD-gravitons.

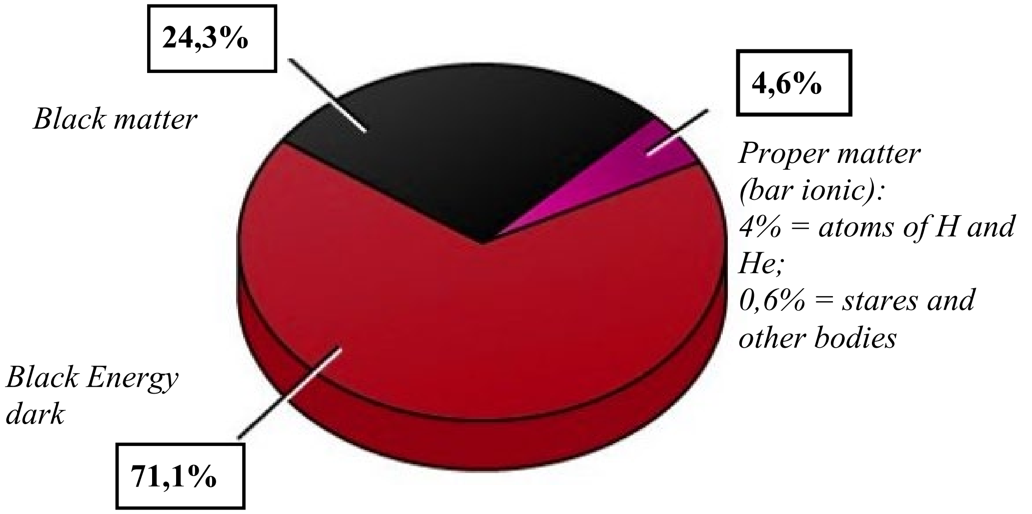

Fig. 1 – Distribution of matter and energy in Universe

Because the HD-graviton is a photon - like particle, it cannot be emitted from a black hole. Therefore, during emission periods the black hole will be stationary ($\frac{M}{R}$ = const). Black holes will only grow during periods of absorption.

According to Fig. 1, **actually**/ in fact, **the Universe is in absorption** because dark matter and dark energy are in high percentage. In his paper [6], S. W. Hawking considered the possibility of Particle Creation by Black Hole. This idea is revisited and the possibility of creating particles is investigated.

First, two possibilities for a black hole model are considered:

a) unstructured black hole, homogeneous (constant density). One problem is that in regions with HD-gravitons, the photon-like particles used to introduce gravity forces, are difficult to observe. On the other hand, for black holes that go far enough beyond $(M/R)_{crit}$ there appears impossible for some parts of the black hole to emit HD-gravitons.
b) structured black hole.

One considers a model to fill a sphere with 11 equal spheres of radius $r_0 = OA/3$ (Fig. 2). In a plane orthogonal to Fig. 2 there is a similar configuration. The space between small spheres is void [3].

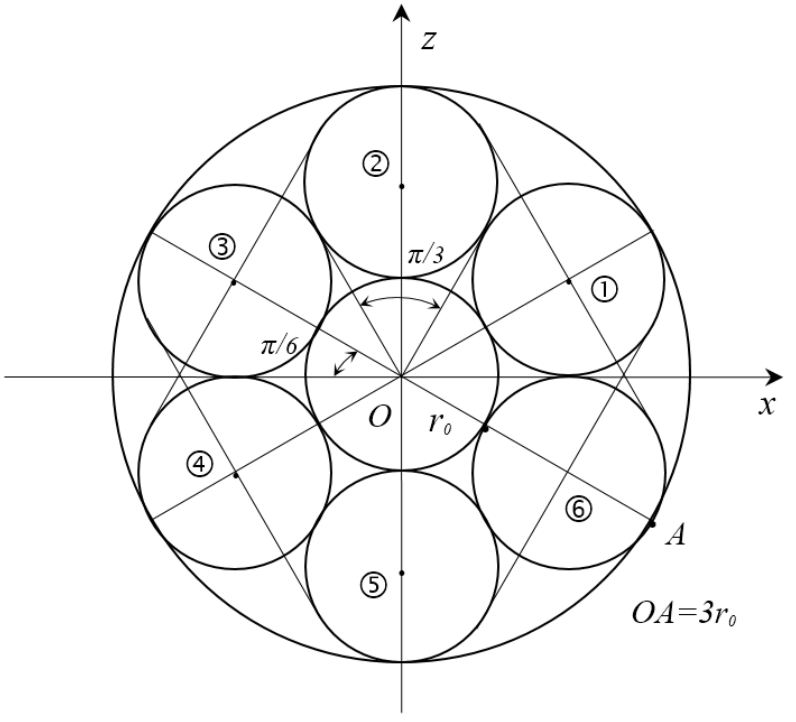

Fig. 2 – A model to fill a sphere with 11 equal spheres of radius a third

If the black hole mass is M_0, the particle mass is:

$$M_{pk} = M_0/11^k, k = 1; 2; 3\ldots\ldots \quad (2)$$

and the corresponding particle radii are:

$$R_{pk} = OA/3^k; k = 1; 2; 3\ldots. \frac{M_{pk}}{R_{pk}} = \left(\frac{3}{11}\right)^k \quad (3)$$

The first particle (the one in the black hole center) has to be compared with the *Schwarzschild radius* R_{Sch} [7, 8, 9], given by the equality:

$$R_{Sch} = \frac{2f_N(t_U)M_0}{c^2} \quad (4)$$

c is the light speed in vacuum.

From relations (1) and (4), one can conclude that for any mass M_k and its Schwarzschild radius R_{Schk} is valid the equality:

$$\frac{M_k}{R_{Schk}} = \frac{6.747E26kg}{m}, \quad (5)$$

giving **the interpretation of Schwarzschild radius as a horizon radius for black bole.**

Taking the exponent *k* correspondingly, in relations (2) and (3) one can obtain the desired particles, in particular avoiding the black hole behavior.

Example of application. One considers a black hole having the ratio BHR=17.36 times 6.747E26 kg/m. corresponding to Sagittarius A.

Applying formulas (2), (3) one obtains a ratio for one inner sphere equal to $17.36\left(\frac{3}{11}\right)^k.6.747\text{E}26 Kg/m$.

Therefore, taking the parameter k conveniently large, one can find a possible new particle having even nuclear dimensions.

For k = 65, for example, one obtains a particle with mass 1.67E-31 kg, comparable with the electron mass (= 9.1094E-31kg).

An interesting thing is a comparison between the Sagittarius density ρ_{Sgt} and Sun density ρ_{Sun}. One obtains:

$$\rho_{Sgt} = \rho_{Sun}\frac{4.1E6}{31.6^3} \cong 130\rho_{Sun} \tag{6}$$

4. CONCLUSIONS

The main conclusions basically used and confirmed by the present study are:

1) a critical ratio mass/frontier radius, for black hole formation was given including the general relativity effects and the gravity coefficient variation with the age of the Universe;

2) The creation of black holes starts with the implosion of a star after the fuel for powering the thermonuclear reactions from inside was consumed. Then more and more mass is added until a critical value of the ratio mass/ radius was obtained;

3) The black hole obtained as above must be structured in a certain way to permit the mechanism of absorption. Because the emission of HD-gravitons is not possible according to the black hole definition, **an alternation of absorption and emission is not possible,** an average allowing an equal density of the HD-regions relative to the overall density of the black hole is possible;

4) A simple scheme to obtain a workable black hole was proposed, starting from [3]; a dependence of the gravity coefficient f_N [3] can also be included.

5) An interpretation of the black/ dark energy and dark/black matter as well as their evolution is suggested by using the HD-gravitons. The actual Universe being in absorption the total dark energy is increasing. The existing black holes are now therefore $\frac{M}{R}$ increasing and the adaption of the structure is necessary.

6) An interpretation of Schwarzschild radius as a horizon for a black hole was given;

7) Particle creation is possible taking corresponding black holes and their division in smaller spheres. The problem of taking these created particles out of the black hole is not considered [6].

However, as far as even a photon cannot leave a black hole, this is more difficult for a particle with the proper mass.

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