Mass limit for a black hole with a strong gravity theory

Zane Andrea Quintili

(Independent scholar)

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Introduction.

We propose in this short document an interpretation for a black hole through a gravitational theory with a gravitational constant of strong gravity (Gq) that we find in the literature described with the symbol Γ. (Ref. 1)

We believe that in nature (regulated by physical laws) only a certain amount of mass can realistically generate a cosmic black hole.

The quantity of this mass is described here:

$$\mathbf{M(Bh) = \frac{8Mp^3}{mp^2} = 2,948\ x\ 10^{31}kg = 14,82\ solar\ masses}$$

Based on the results of our equations we have seen that the Cygnus X-1 black hole perfectly meets the mass requirements proposed here for a stellar black hole, so much so that in our opinion we can consider Cygnus X-1 a real black hole .

The mass value for the Cygnus X-1 black hole is estimated by astronomers in the latest data processing at 14.8 solar masses. (Rif.2)

This observation is perfectly in line with our prediction for the amount of mass necessary to define whether a cosmic object can be considered a black hole or a body of a different nature, while showing strong if not extreme gravitational interactions.

We also calculated that its internal temperature is a measure in line with the theoretical predictions for the temperature of a stellar black hole which in this equation has been reduced to the use of the proton mass and by the Planck, Tp and Mp units.

$$\mathbf{T(Bh) = \frac{Tp\ mp^2}{8Mp^2} = 1,045\ x\ 10^{-7}K}$$

Description:

We have shown in one of the documents previously published on the free portal of Vixra.org (Ref. 3) that through the use of a theory of strong gravity it is possible to define and estimate the radius of the proton in accordance with the experimental results published in 2019 which they gave the proton a radius of 0.833 (0.01) fm. (Ref.4)

Using strong gravity we obtain this formula to define our estimate:

$$\mathrm{Rp} = \frac{\mathrm{Gq\ mp}}{2\mathrm{c}^2} = 8{,}412 \text{ x } 10^{-16}\mathrm{m}$$

where is it:

Rp - proton radius; Gq - gravitational constant of strong gravity; mp - mass of the proton

Value attributed to Gq: $\mathrm{Gq} = 9{,}0404 \text{ x } 10^{28}\,\frac{\mathrm{m}^3}{\mathrm{kg\ s}^2}$

In conditions of strong gravity that is, with strong gravity constant or quantum gravitational constant Gq, the Planck mass (Mp) turns out to have this radius:

$$\mathrm{R(Mp)} = \frac{\mathrm{Gq\ Mp}}{2\mathrm{c}^2} = 1{,}095 \text{ x } 10^4 \text{ m}$$

In conditions of universal gravity with gravitational constant G, it turns out to be equal to:

$$\mathrm{R(Mp)} = \frac{\mathrm{G\ Mp}}{2\mathrm{c}^2} = \frac{\mathrm{Lp}}{2} = 8{,}081 \text{ x } 10^{-36} \text{ m}$$

The value of the maximum universal gravitational force is described as:

$$\mathrm{Fg} = \frac{\mathrm{c}^4}{\mathrm{G}} = \frac{\mathrm{Mp}^2\mathrm{c}^3}{\hbar} = \frac{\mathrm{Ep}}{\mathrm{Lp}} = 1{,}211 \text{ x } 10^{44}\mathrm{N}$$

We can describe the gravitational attraction force between two Planck mass bodies (Mp), through Newton's formulation in Planck units:

$$\mathrm{Fg} = \mathrm{G}\frac{\mathrm{Mp}^2}{\mathrm{D}^2} = 1{,}211 \text{ x } 10^{44} \text{ N}$$

where:

$$\mathrm{D} = \sqrt{\frac{\mathrm{G\ Mp}^2}{\mathrm{Fg}}} = \sqrt{\mathrm{Lp}^2} = \mathrm{Lp}$$

So if D is the minimum distance between the two centers of mass of Mp and this measure is equal to the measure of Lp, the radius of each mass will be equal to:

$$R = \frac{D}{2} = \frac{Lp}{2}$$

That is, for the radius of Planck's mass in standard gravity conditions, as described above using Newton's universal gravitation formula, the following relation will apply:

$$R(Mp) = \frac{G\ Mp}{2c^2} = 8{,}081 \text{ x } 10^{-36}\text{m} = \frac{Lp}{2}$$

At this point we can draw a boundary line between the universal gravitational constant G and the strong gravity constant Gq to define the assessments on the Planck scale, noting that the ratio between Gq / G is equal to:

$$\frac{Gq}{G} = 1{,}354 \text{ x } 10\text{^}39$$

This is equivalent to the ratio of the values of the coupling constants of strong force and gravity.

$$Ff/G = 1/10\text{^-}39$$

Assuming that, under standard gravity conditions with universal gravitational constant G, a black hole respects the same constraint of strong gravity for the Planck mass, we assume the hypothesis for the mass of a black hole:

$$R = \frac{Gq\ Mp}{2c^2} = \frac{G\ M(Bh)}{2c^2} = 1{,}095 \text{ x } 10^4\text{m}$$

From which we obtain the mass of the black hole M (Bh):

$$M(Bh) = \frac{Gq}{G} Mp = 2{,}948 \text{ x } 10^{31}\text{kg} = 14{,}82 \text{ solar masses}$$

This equivalence can be transformed and reduced into an equation that highlights the close relationship that exists between the Planck mass and the proton mass.

$$\mathbf{M(Bh) = \frac{8Mp^3}{mp^2} = 2{,}948 \text{ x } 10^{31}kg = 14{,}82 \text{ solar masses}}$$

As previously mentioned, the astronomical observations referring to the Cygnus X-1 black hole tell us that its mass is estimated at 14.8 solar masses and since this observed object has the same mass characteristics for a stellar black hole described by us here, we think Cygnus X-1 can really be defined as a black hole.

We propose below with the same method used for the mass of a black hole, a solution for the internal temperature of a black hole.

To describe the (expected) temperature for a black hole T (Bh), in conditions of universal gravity we use this description of ours by equating it to the Planck temperature formula:

$$Tp = \frac{\hbar c^3}{G\ Mp\ Kb} = \sqrt{\frac{\hbar c^5}{G\ Kb^2}} = 1{,}416 \text{ x } 10^{32}K$$

$$T(Bh) = \frac{\hbar c^3}{G\ M(Bh)\ Kb} = 1{,}045 \text{ x } 10^{-7}K$$

Which is equivalent to the temperature of a Planck mass black hole (Mp) subjected to conditions of strong gravity (for masses below the Planck scale where $M < Mp$) with gravitational constant Gq.

$$T(Bh) = \frac{\hbar c^3}{Gq\ Mp\ Kb} = \frac{Tp\ G}{Gq} = 1{,}045 \text{ x } 10^{-7}K$$

Also in this case we can transform the equivalence by showing the close relationship with the proton mass.

$$T(Bh) = \frac{Tp\ G}{Gq} = \frac{Tp\ mp^2 G}{8\hbar c} = \frac{Tp\ mp^2}{8Mp^2} = 1{,}045 \text{ x } 10^{-7}K$$

Conclusions:

We believe on the basis of observations and experimental data that the prediction for the mass of a black hole proposed by this theory of strong gravity can find support and confirmation in them.

We believe that the minimum limit for the mass of a stellar black hole is an iron and impassable limit defined by the forces on which the equations described here depend.

We also believe that this limit could lead us to consider massive and super massive black holes as a whole, an aggregation of single black holes and not a real fusion of multiple black holes.

A super massive black hole (Bh-sm) could therefore be composed of tens, hundreds, thousands or billions of black holes according to this simple relationship:

$$M(Bh\text{-}sm) = N \text{ x } M(Bh) = 1,2,3,4... \text{ x } 14{,}82 \text{ solar masses}$$

The core of a maxi final black hole that contained all the matter present in the Universe which according to our estimate turns out to be Mu = 2,184E56 kg, would no longer have a horizon of events, since it would have the same dimensions as the radius of the Universe (Ru) itself and a temperature equal to:

$$Ru = R(Bh) = \frac{G\,Mu}{2c^2} = 8{,}11 \text{ x } 10^{28}\text{m}$$

$$T(Bh) = \frac{\hbar c^3}{G\,Mu\,Kb} = 1{,}411 \text{ x } 10^{-32}\text{K}$$

According to our analysis, the Schwarzschild Ray represents exactly four times the radius of the Universe estimated by us. (Ref.4)

We are sure that many questions still remain open, however we are confident in the usefulness of this study of ours that we allocate to the entire scientific community.

Zane Andrea Quintili

E-mail: zaneandreaquintili@gmail.com

References:

(Rif.1)https://en.wikiversity.org/wiki/Strong_gravitational_constant Strong gravity constant

(Rif.2) https://it.wikipedia.org/wiki/Cygnus_X-1 Cygnus X-1 the black hole of 14.8 solar masses

(Rif.3) https://vixra.org/author/zane_andrea_quintili Strong gravity

(Rif.4) https://science.sciencemag.org/content/365/6457/1007 Experimental proton radius

(Rif.5) https://vixra.org/1912.0471 Schwarzschild radius