Is a Black hole a Neutron star?

Abstract

The connection between a Black hole and a Neutron star is shown. I postulate that both bodies have the same physical structure, namely, the nucleons of both bodies are so packed that their densities are the maximum possible in the Universe. It is interesting to note that the density of the nucleus of the atom has the same structure and the same density. Neutron stars have been observed in the Universe, whereas Black holes were not. The existence of Black holes is deduced from observing motion of stars around an invisible object that has a huge mass. I postulate that the reason why a Neutron star is visible whereas a Black hole is not, is the ratio between the physical radius of the body and its Schwarzschild radius.

Black hole existence was predicted by solving Einstein's general relativity equations. Mathematically, the equations show that it is possible to have a singularity. The meaning of this singularity is that the mass of a Black hole is confined to an infinitely small point at its center, thus the density at this point is infinite. The main problem with this result is that, at the singularity, the laws of physics don't work. This is what makes the Black hole a mystery and gives rise to mind-boggling theories such as that Black holes are portals to other Universes, or that it is possible to travel in time.

I claim that although this solution is mathematically possible, it does not have a physical meaning. (Note: the same argument was also expressed by… Einstein). In addition, I postulate that there is a limit to the maximal density of bodies in the Universe. The current prevailing theory is as follows: (See also: https://www.youtube.com/watch?v=...) A Black hole is created when a star consumes its fuel and then gravitationally collapses. The end of this process is dependent on the mass of star. If the mass of the star is 1.39 solar masses (designated as Chandrasekar limit), gravity is strong enough to combine protons and electrons to make Neutrons and thus creating a Neutron star. The Neutrons, and residual protons are packed in the Neutron star at their maximum density. According to current theory, if the mass of the star is between 1.5 to 3 solar masses gravity becomes strong enough to break the nucleon into its constituents (quarks) and then the star becomes a Black hole that has a singularity point at its center with an infinite density.

Partially, I concur with the current theory. Specifically: 1) The origin of a Neutron star and a Black hole is the gravitational collapse of a star. 2) The final mass of the Neutron star or the Black hole relates to the initial mass of the star. Neutron stars have been observed in the Universe. The Neutron star contains nucleons (Neutrons and protons) that are packed to the maximum density possible in the Universe. The density of a Neutron star is 3.7x10^17 to 5.9x10^17 kg/m^3, which is comparable to the approximate density of an atomic nucleus of 3x10^17 kg/m^3. The surface temperature of the Neutron star is extremely high ~600,000K. https://en.wikipedia.org/wiki/Neutron_star

As for the Black hole: I claim, that the mechanism that creates a Neutron star is also applicable to a Black hole. I mean that the creation of a Black hole is not by compressing its mass further, thus breaking of nucleons into their fundamental constituents, as postulated by current theory, but rather by adding nucleons to the nucleus to get the maximum density. There are two reasons for my claim. The first is theoretical - Pauli's exclusion principle – this principle forbids two identical fermion particles to occupy the same place at the same time. The second is experimental - in tests done in particles colliders, it was found that the force between two nucleons is attractive and repulsive as shown in Fig. 1. [Nuclear force - Wikipedia](). This graph is based on Reid's semi-empirical formula for the potential and the force between nucleons. In this graph, the force (in Newtons) is plotted against the range - the distance between two nucleons center (fm). The graph shows that for r smaller than 0.8fm, the force becomes repulsive. Analyzing Reid's formula shows that at r=0 the potential as well the force between nucleons becomes infinite.

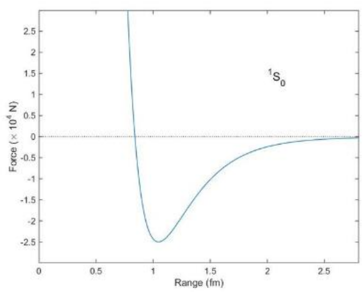

Fig. 1 - Forces between nucleons

In a recent experiment done by nuclear physicists at Jefferson Lab the distribution of pressure inside the proton was measured. They found that the proton's building blocks, the quarks, are subjected to a pressure of 100 decillion Pascal (10^35) near the center of a proton, which is about 10 times greater than the pressure in the heart of a Neutron star. This means that the outward-directed pressure from the center of the proton is greater than the inward-directed pressure near the proton's periphery and therefore the nucleon cannot collapse. https://www.jlab.org/node/7928

From the above description my conclusion is that two nucleons cannot be squeezed into the same space.

Fig. 2 shows schematically how nucleons are packed in a Neutron star as well as in a Black hole. I claim that in both cases, the nucleons are packed to the maximum density possible in the Universe. The only physical difference between a Neutron star and a Black hole is the number of nucleons it contains. It is important to note that this figure represents also the structure of the nucleus of an atom, it is also packed to the maximum density in the Universe.

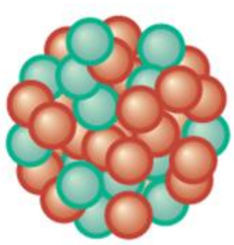

Fig. 2 – Densely packed nucleus

In view of the description above, the question now is how come that Black holes are not directly observed, while Neutron stars are observed. My theory is: The visibility of a celestial body depends on the relation between the radius of the nucleus and its Schwarzschild radius. If a celestial body has a nucleus radius that is bigger than its Schwarzschild radius, it will be observed. On the other hand, if a celestial body has a nucleus radius that is smaller than its Schwarzschild radius, it will be hidden.

This is exemplified in the following calculations:

1. A Neutron star, twice the mass of the Sun:

Mass of Proton:	$m_{proton} = 1.6726 \cdot 10^{-27} kg$
Radius of Proton:	$\rho_n = 0.85 \cdot 10^{-13} cm$
Gravitational constant:	$G = 6.67 \cdot 10^{-11} \frac{m^3}{kg \cdot \sec^2}$
Light velocity:	$C = 2.99 \cdot 10^8 \frac{m}{\sec}$
Mass of neutron star:	$M_{NS} = 4 \cdot 10^{30} kg$
Number of neucleons :	$N_{NS} = \frac{M_{NS}}{m_{proton}} = 2.4 \cdot 10^{57}$

The nucleon radius of a densely packed Neutron star is:

$$R_{NS} = \rho_n \cdot (N_{NS})^{1/3} = 11.4 km$$

The Schwartzschild radius of this Neutron star is:

$$\mathrm{R}_{S\_NS} = \frac{2 \cdot G \cdot M_{NS}}{C^2} = 5.97 km$$

In this case:

$$R_{NS} > \mathrm{R}_{S\_NS}$$

Conclusion: This Netron star is visible

2. The Black hole in the center of the Milky Way,
four million times the mass of the Sun:

Mass of Black hole: $M_{BH} = 8 \cdot 10^{36} kg$

Number of neucleons : $N_{BH} = \frac{M_{BH}}{m_{proton}} = 4.8 \cdot 10^{63}$

The nucleus radius of this densely packed Black hole is:

$$R_{BH} = \rho_n \cdot (N_{BH})^{1/3} = 1.4 \cdot 10^3 km$$

The Schwartzschild radius of this Black hole is:

$$\mathrm{R}_{S\_BH} = \frac{2 \cdot G \cdot M_{BH}}{C^2} = 1.2 \cdot 10^7 km$$

In this case:

$$R_{BH} < \mathrm{R}_{S\_BH}$$

Conclusion: This Black hole is is not visible

It is obvious from the discussion above that there a upper limit to the mass of a Neutron star. At this limit, if more mass is added to the Neutron star it will become a Black hole. The limit mass can be found by equating the Schwarzschild radius to the radius the nucleus of the Neutron star.

$$M_{Limit} = (\frac{\rho_n \cdot C^2}{2 \cdot G \cdot m_{proton}^{1/3}})^{3/2} = 1 \cdot 10^{31} kg \sim 5.25 Sun - masses$$

This result is in good agreement with observations. The smallest Black hole observed in the Universe is XTE_J1650-500. It was claimed that this black hole had a mass of 3.8 solar masses, which would have been the smallest found for any black hole; smaller than GRO 1655-40, the then known smallest of 6.3 solar masses. However, this claim was subsequently retracted and the more likely mass is 5–10 solar masses. Therefore, the smallest Black hole will be between 5 to 6.3 solar masses. https://en.wikipedia.org/wiki/XTE_J1650-500

To sum up:

1) A Black hole is basically a Neutron star. Like a Neutron star (and also the nucleus of an atom) it is compressed to the maximum density possible in the Universe.

2) A Black hole must have a mass that is bigger than ~5.25 Sun masses. At this mass the physical radius of the Black hole is smaller than its Schwarzschild radius.

3) It is possible that the temperature of the Black hole is equal or higher than the temperature of a Neutron star. However, this temperature cannot be measured by an observer outside the Schwarzschild radius.

4) It can be shown that the gravity of the 2 Sun masses Neutron star and the Black hole in the center of the Milky Way have a gravity of 2x10^12 m/sec^2 and 2.6x10^14 m/sec^2 respectfully.

5) The physical conditions of 3) and 4) show that a Black hole cannot be a portal to other Universes. This conclusion must be very disappointing to SCI-FI fans (including myself). Trying to dive into a Black hole in order to travel to another Universe will be very painful and fatal.