

Black Mass in the Universe

¹M. Kumar, ²S. Sahoo

^{1,2} Department of Physics, National Institute of Technology, Durgapur – 713209, West Bengal, India

² sukadevsahoo@yahoo.com

ABSTRACT

There is creation of mass due to strong interaction among the three quarks inside the nucleons. The sum of the masses of these quarks is approximately 1% of the mass of the nucleons. Analogous to this there is attainment of mass in the universe due to strong gravitational interaction among three black holes which may be several times greater than the sum of the masses of the black holes which may be called as black mass. It predicts the cosmological model of the universe to be closed. The creation of black mass leads to the creation of dark energy that is responsible for the accelerating expansion of the universe.

Keywords: *Black hole, gravitation, black mass, black elements, big crunch, dark energy*

1. BLACK MASS AND BLACK ELEMENTS IN THE UNIVERSE

John Wheeler coined the phrase “mass without mass” [1]. With this idea, we can account the fundamental particle masses in terms of fields [2]. In quantum chromodynamics (QCD), the protons and neutrons are built up from quarks and gluons. The masses of up and down quarks are $3 \text{ MeV}/c^2$ and $7 \text{ MeV}/c^2$ respectively, but the proton, which is made up of two up quarks and one down quark, have a mass of $938 \text{ MeV}/c^2$. The difference, nearly 99% of the proton’s mass, arises from the energy of the quark’s force fields. Similarly, a neutron’s mass is far larger than the sum of the masses of its three quarks (one up and two down quarks). Hence, we can say that approximately 99% of the mass of a nucleon arises from these fields. The theory of color gluons is derived from a powerful symmetry principle – non-Abelian or Yang-Mills gauge symmetry. Gauge symmetry forbids mass terms for the gluon fields. Thus color gluons have no mass. Furthermore, the masses of up and down quarks are very small. Let us assume them as zero. How is it possible that massive protons and neutrons can be built up out of mass less quarks and gluons? We know $m=E/c^2$. There is energy stored in the motion of the quarks, and energy in the color gluon fields that connect them. This bundling of energy makes the proton’s mass. Quarks carry color charge, and generate color electric fields around electrons. Unlike ordinary electric fields, color electric fields do not automatically fall off rapidly far from their source. Indeed, the color electric field energy generated by an isolated quark is infinite, due to the energy it creates in distant fields. This property explains why quarks cannot be seen in nature as free particles like electrons. According to QCD, this color field energy makes us weigh. It thus provides, “mass without mass” [3,4].

In this paper, analogous to the above phenomena we want to discuss the creation of black mass in the universe due to interaction among three black holes under strong gravitational field. There is creation of mass inside the nucleons due to mutual interaction among quarks under strong interaction fields. Analogous to this, there is creation of mass in the universe due to mutual interaction among three black holes under strong gravitational fields

which we can say as the creation of black mass. If m_1, m_2, m_3 are the masses of the three mutually interacting black holes and M is the black mass created, then M is several times greater than the sum of masses of these black holes. Since black holes can be made analogous to quarks in black mass system, the black mass created can be said as black nucleon analogous to nucleons viz proton, neutron. Since atomic nucleus is made up of single nucleon or more than one nucleon, a black nucleus is made up of a single black nucleon or a system consisting of more than one black nucleon. An atom consists of electron or electrons revolving around the nucleus. Analogous to an atom a black atom can be said to consist of galaxy or galaxies revolving around the black nucleus. Our Milky Way galaxy can also be revolving around a black nucleus. And our solar system can be one of the components of this black atom. Analogous to different elements found on the earth, black elements can be treated as atoms consisting of black nucleus with different number of black nucleons.

Considering black mass, black nucleon, black nucleus, black atoms as black elements of the universe which is totally based on strong gravitational field, creation of black mass can be one of the important steps in the quantum theory of gravity. We can say for black nucleons, gravitational field behaves similar to strong force in case of atomic nucleons.

2. BLACK MASS, BIG CRUNCH AND DARK ENERGY

Due to creation of black mass there will be sudden increment in the density of the universe. If this phenomenon goes on taking place continuously, the density of the universe will go on increasing continuously and will surpass the critical density of the universe. The universe will start contracting and finally will collapse as big crunch to a singular point where the density will become infinity. The collapsing of the universe as big crunch is one of the three possibilities of the cosmological models of the universe [5]. When will this phenomenon take place in the universe is totally unpredictable. The possibility of the universe to be open or flat will be totally

<http://www.ejournalofscience.org>

abolished out and the universe will be fully closed universe.

Since there is creation of huge mass due to interaction among three black holes within a very small volume, the density of the black mass created may exceed the Planck density. This will lead to production of gravitational repulsive force around the black mass [6]. This repulsive force may be called as dark energy [7–12] which is responsible for the accelerating expansion of the universe.

3. CONCLUSION

Creation of black mass in the universe is a unique phenomenon occurring in the universe. It explains the cosmological model of the universe and predicts the maximum probability of the universe to be closed. Creation of dark energy due to creation of black mass with density greater than Planck density is liable for the accelerating expansion of the universe. In future, it may be helpful in the unification of gravitational field and strong force and hence quantum theory of gravity.

REFERENCES

- [1] J. A. Wheeler. 1962. *Geometrodynamics*, Academic Press, New York, p. 25.
- [2] A. Hobson. February 2005. *The Physics Teacher* 43, 80.
- [3] F. Wilczek. November 1999. *Phys. Today*, 52, 11.
- [4] F. Wilczek. November 2000. *Phys. Today*, 53, 13.
- [5] A. Beiser. 2004. *Concepts of Modern Physics*, 6th Edition, Tata McGraw-Hill Company Limited, New Delhi.
- [6] M. Bojowald. 2011. *Nucl. Phys. A*, 862–863, 98 [arXiv: 1109.0248 [gr-qc]].
- [7] A. G. Riess et al. (High-z Supernovae Search Team). 1998. *Astron. J.* **116**, 1009.
- [8] S. Perlmutter et al. (Supernovae Cosmology Project). 1999. *Astrophys. J.* 517, 565.
- [9] A. G. Riess et al. 1999. *Astron. J.* 117, 707.
- [10] P. M. Garnavich et al. 1998. *Astrophys. J.* 493, L53.
- [11] A. G. Riess et al. 2004. *Astron. J.* 607, 665.
- [12] J. L. Tonry et al. 2004. *Astrophys. J.* 594, 1.