Research proposal

Gravity, Cosmological Constant Problem and Cosmic Acceleration

Kapil Chandra
Chhattisgarh state police, Bastar (cg) India
kapil.chandra@hotmail.com

Project statement

The cosmological problem has been a long standing unsolved problem of physics. In this manuscript, we propose a new hypothesis to solve it and we reported that the theoretically calculated value is in good agreement with its current observed value. We also derived a new mathematical expression of gravity which is inverse of classical Newton gravity, our hypothesis suggests; the inversion of gravity is responsible for cosmic acceleration. It has been also explained, why the gravity is too weak force of nature. We reported here, there is a close link between the weak gravity and cosmological constant problem.

Our hypothesis needs further modifications and rectifications, it has potential to explain why gravitational force depends on mass and space or simply we can say why there is gravitational interaction? However, I want to be a doctoral student at your edge cutting research group to get benefit of expertise knowledge and other resources available there. I have potential to organize my doctoral work independently with the group spirit.

The unsolved problem of physics

There are few problems, which we will take in consideration,

1. Why there is gravitational coupling constant? Why the gravity is weak force of nature?
2. The cosmological constant problem. [1- 4].
3. What is the size of first atom of universe? Does any theory predict the first atom of universe? Why the Hydrogen is first atom of universe as we observe it?[5,6]

Ideas to meet these open questions

I am working independently on above mentioned question and got some interesting and stimulating results, which are in good agreement with the observe values. In brief, I m going to introduce my ideas in proceeding paragraphs:

a) ***Why gravity is too weak force of nature*****:**

It has been a very serious question of fundamental physics that, why the gravity is such a weak force of nature? We try to meet this open question theoretically, and this can be done as given below,

To determine the weakness of gravity first of all we need to know the theoretical numerical amount of strong nuclear force. To our knowledge, till date there is no any

mathematical expression to equate it theoretically, however, we propose an empirical expression to calculate it as written below,

$$F = \frac{hc}{r^2} \tag{1}$$

Where used constants have its usual meanings and the values it holds. The $\boldsymbol{r}$ is the size of nucleolus; it gives the numerical value of strong nuclear force.

To find the comparative strength of gravity, we use a force balance equation that is,

$$\frac{hc}{r^2} \times \frac{m^2c^3}{h} = G\frac{m^2}{r^2} \times \frac{c^4}{G} \tag{2}$$

This is mathematically and dimensionally balanced and it corresponds to the,

$$\frac{hc}{r^2} = G\frac{m^2}{r^2} \times \frac{\frac{c^4}{G}}{\frac{m^2c^3}{h}} \tag{3}$$

where $\boldsymbol{m}$ is mass of proton that is itself a constant however we will get a constant term, $\frac{\frac{c^4}{G}}{\frac{m^2c^3}{h}}$ and its numerical value is about10^{+39}. We observe, this term has high value itself, and it results the Weak gravity.

The eq. (2) corresponds to,

$$r = \frac{h}{mc} = 10^{+39}\frac{Gm}{c^2} \tag{4}$$

b) Theoretical value of cosmological constant:

The next big problem of theoretical physics is, the prediction of the valve of cosmological constant, this problem is defined as cosmological constant problem. We fixed it as given below,

It has been known that,

$$F = \frac{r^2c^7}{G^2h} \tag{5}$$

here we took, $\boldsymbol{E} = \boldsymbol{F} \times \boldsymbol{r}$ and$\boldsymbol{\rho} = \frac{\boldsymbol{E}}{\boldsymbol{r^3}}$ however, the vacuum energy density would be,

$$\rho = \frac{c^7}{G^2h} \tag{6}$$

Thus after the correction the above equation will turn out in followings,

$$\rho = \frac{c^7}{G^2h(10^{39})^3} \tag{7}$$

If we substitute the value of the entire constants we will get the numerical amount of vacuum energy density nearly $10^{-10}J/m^3$that is close to the observed values [7]. However, we conclude that our hypothesis is in good agreement with the principal what governs the nature.

c) The first atom of universe theoretically predicted, that is hydrogen atom:

On basis of this hypothesis we theoretically predicted the size of first atom of universe and we found that the first atom is hydrogen atom itself and it is widely observed. This would be helpful to understand the very first atom of universe.

What I predict from my own hypothesis:

1. ***The force responsible for cosmic acceleration, the dark force:*** we found the gravity is reversed at large distance. The derived mathematical expression is given below,(derivation is somewhere else)

$$F = \frac{r^2 c^8}{m^2 G^3} \tag{8}$$

we concludes, the distance is increased the force is increased; probably this is the reason of cosmic acceleration. We need further work in this equation. The role of this equation is unknown. We named it dark force, because it is responsible for accelerated expansion of universe instead of the so called dark energy.

2. ***Correction Planck in unit***: the natural unit needs to be corrected, Planck derived it only by relating the fundamental constant of nature such as G, h and c only and found

$$hc = Gm^2$$

if we believe it, we can't explain the gravitational coupling constant because it says the gravity has the same strength as the strong nuclear force is. Apart to it, it can't predict the cosmological constant, it gives high value, and thus we need to correct it by inserting an additional dimensionless constant

$$hc = 10^{+39} Gm^2 \tag{9}$$

as given in eq. (3). This leads to many corrections in fundamental physics where Planck unit are used. This can be deduct form eq. (5) itself.

3. ***Hawking temperature to be corrected subsequently:*** as we predicted, there it needs to add some numerical constant in Planck Unit or scale and it is used to derive the Hawking temperature [8,9]. Thus we need to modify the mathematical expression for Hawking temperature by inserting the additional constant.

Since we know that, $E = \frac{hc}{\lambda}$ and $\lambda = 2\pi r$. From eq. (4) the right expression for hawking temperature will be,

$$E = k_B T = \frac{hc^3}{10^{+39} Gm} \tag{10}$$

One can conclude that the Hawking temperature must be much less than to the predicted by him. This needs experimental verification.

4. ***Possibility of Planck atom***: it is one of the unsolved problems of physics and we reported the first atom is only Hydrogen atom itself, if we use the correction in Planck's unit we will get, the Planck mass will equal to proton mass and Planck length will be the radius of nucleus.

What we will do further during the doctoral studies:

Further task is summarized below,

1. What gives the gravity or why there is gravitational interaction?
2. Why gravity is a function of mass and space or distance of the bodies?
3. Does Planck unit are possible? Are there any experimental result or observation that confirms this unit?

4. Correction in Hawking temperature expression.
5. What is the nature of dark force or dark energy?
6. Does there is dark matter?
7. Other relevant or encountered problem while studies

Significance/contribution of this hypothesis to the discipline:

Our hypothesis will have some interesting contribution to the concern discipline as listed below,

1. Long standing problem, the cosmological constant problem will be solved.
2. The reason of cosmic acceleration is proposed.
3. Planck unit will be corrected.
4. Help to relate the gravity with the strong nuclear force and we found the value of gravitational coupling constant.
5. Help to understand the universe and its origin
6. Deeper view in cosmology.

Theoretical framework and method:

Initially, we will work theoretically and match the predicted result with the observed results. We will stick to meet the basic problem of fundamental physics. Further we will extend our work to in search of Dark Matter.

Thesis duration: 3 years

First two year will be dedicated to our proposed work. Last year will be devoted to meet other encountered problem and final thesis preparation. I will organize my work independently with close collaboration to the research group. I will work there as a member of a team with team spirit.

References:

1. Weinberg, S. Reviews of Modern Physics,61, p.1 (1989).
2. Carroll, S.M. "The Cosmological Constant", Living Rev. Relativity,4, (2001),1, http://www.livingreviews.org/Articles/Volume4/2001-1carroll
3. Padmanabhan, T.,Cosmology and Astrophysics through Problems, Cambridge University Press, (1996).
4. Straumann, N. The history of the cosmological constant problem, grqc/0208027.
5. S Weinberg, first three minute, Fontana Paperbacks, 1976
6. Dolgov, A. D. "Big Bang Nucleosynthesis." Nucl.Phys.Proc.Suppl. (2002
7. Rugh S.E and Zinkeragel H., ariv:hep-th/001225v1
8. Hawking S.W., *Nature* **248**, 30 - 31 (01 March 1974); doi:10.1038/248030a0
9. Hawking S.W., "in black holes" (edi by De witt CM and De witt BS) Les Houches summer school 1973 (Gorden and breach, New York1973)