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New Approach to Synchronize General Relativity and Quantum Mechanics with Constant "*K*"-Resulting Dark Matter as a New Fundamental Force Particle

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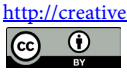

Abstract

Planck scale plays a vital role in describing fundamental forces. Space time describes strength of fundamental force. In this paper, Einstein's general relativity equation has been described in terms of contraction and expansion forces of space time. According to this, the space time with Planck diameter is a flat space time. This is the only diameter of space time that can be used as signal transformation in special relativity. This space time diameter defines the fundamental force which belongs to that space time. In quantum mechanics, this space time diameter is only the quantum of space which belongs to that particular fundamental force. Einstein's general relativity equation and Planck parameters of quantum mechanics have been written in terms of equations containing a constant "*K*", thus found a new equation for transformation of general relativity space time in to quantum space time. In this process of synchronization, there is a possibility of a new fundamental force between electromagnetic and gravitational forces with Planck length as its space time diameter. It is proposed that dark matter is that fundamental force carrying particle. By grand unification equation with space-time diameter, we found a coupling constant as per standard model "α_s" for that fundamental force is 1.08×10^{-23}. Its energy calculated as 113 MeV. A group of experimental scientists reported the energy of dark matter particle as 17 MeV. Thorough review may advance science further.

Keywords

General Relativity, Quantum Mechanics, Space Time, Dark Matter, A New Fundamental Constant "*K*"

1. Introduction

Fundamentally quantum mechanics is not synchronizing with general relativity because, at quantum level *i.e.* beyond a limit, general relativity equations cannot explain space time. Quantum mechanics describes discreteness of space time and general relativity interprets continuous and smooth space time. If we consider general relativity as most fundamental and explainable by geometry, quantum theory, the basis of understanding matter from elementary particles, is unexplainable by space time geometry at quantum level. However, how to reconcile quantum theory with general relativity is still an open question. Relativistic quantum mechanics is application of special relativity for quantum particles. It is not a theory to reconcile quantum mechanics with general relativity. Dirac equation is resultant of this concept [1] [2] [3]. According to General Relativity, the conventional gravitational wave is a small fluctuation of curved space time. It separates from its source and propagates independently. These cannot be completely justified in a theory with exact Lorentz symmetry. They are not perfectly described by relativistic theory.

In previous paper [3], the conceptual and physical interpretation of quantum coordinates into Lorentz or Minkowski's space time and the space time incorporated in general relativity have been discussed. It concluded that the mathematical interpretation of space time curvature is possible by the concept of physical transformation of quantum states represented by quantum coordinates to space time coordinate system of reality. This is also based on special relativity only. It is nothing to do anything with general relativity.

General relativity equations describe space time curvature. When it is applied to black holes, the physical quantities such as space time divergence at the center of black holes, when it goes closer to the center, less than Planck length distance, there is a breakdown of General Relativity (GR) equations. There must be a new theory which goes beyond GR and dominated by quantum mechanics. Thus, quantum gravity theories originated. The main result of loop quantum gravity is the derivation of a granular structure of space at the Planck length. The quantum state of space time is described in the form of spin networks, "loop quantum gravity" or "quantum geometry". Much of the work in this area is based on Dirac quantization of the constraints, though there have been recent advances in the use of covariant "spin foam" methods [4] like glue of quantum spin foam or fusion by a quantum building block or the notion of quantum tetrahedron, a quantization for geometry [5].

Similarly in the framework of attempts to quantize gravity, we discussed an intermediate step which consists in extending the picture of standard general relativity in the framework of extended theories of gravity with production of massless and massive particles also explained by few others [6]. As per their arguments, variations of an intrinsic curvature generate the mass-energy. "Dark energy", "dark matter" and the pioneer anomaly are interpreted like pure curvature effects.

Another work [7] emphasized a scheme for explaining how the re-emergence of the smooth spacetime from the underlying discrete quantum structure could be understood.

All the above models are based on space time geometries, renormalization [4] [8], space time coordinates defined by Newtonian, Galilean, Lorentz etc. But nowhere connected to concept of space time diameter which plays a significant role such as signal for transformations as well as flat space time of general relativity. The disappearance of space time [7] is explained by a simple physical interpretation of signal in special theory of relativity. Photon contains a space time diameter but, its space time disappears since it is the maximum velocity in our four-dimensional space time and it is the signal that transforms all physical systems in to another frame of reference. It is applicable for all fundamental forces and force carrying particles. This approach explained that there will exist a new fundamental force and its force carrying particle is dark matter. Its mass and coupling constant can be calculated by new space time equations.

2. Theory and Discussion

Flat space time defined as "Every mass occupies space time. So, mass will have a specific volume. If volume of mass exactly equals to its space time volume, the space time is said as flat space time" [9].

Planck hole is a flat space time since the volume of mass it contains is exactly as its volume [9].

Every space time contains a repulsive force follows the equation $V = Hd$ and attractive force with $Vd = K$ [9]. "d" is constant for a flat space time. If the space time has curvature, the "d" will vary.

2.1. Einstein's General Relativity Equation in Terms of Constant "K"

Einstein's field equation is

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \kappa T_{\mu\nu} \tag{1}$$

where $G_{\mu\nu}$ is Einstein Tensor

$$G_{\mu\nu} = R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} \tag{2}$$

$R_{\mu\nu}$ is Ricci curvature Tensor.
R is scalar curvature.
$G_{\mu\nu}$ is metric tensor.
$T_{\mu\nu}$ is stress-energy tensor.
Λ is cosmological constant.
G is gravitational constant and,
c is velocity of light.
κ is Einstein's gravitational constant.

$$\kappa = \frac{8\pi G}{c^4} = 2.077 \times 10^{-43}\ \mathrm{N}$$

Physically it elaborates curvature of space time in the presence of matter.

And the right-hand side indicates stress energy momentum of that curvature of space time.

The following are the classical Equations for space time [10] after considering final revision

$$m = 7.9905778 \times 10^{-17} \times d^{1/3} \tag{3}$$

$$\gamma d^{8/3} = 1.526087946 \times 10^{-16} \tag{4}$$

As per classical concept of space time, every mass will be associated with its own space time for its existence, space (more precisely space time). The distance between any two points depends on the space time associated to that mass. If that space time is less than the required, that space time cannot be flat and will have a curvature. Here space time density plays an important role. If mass density and space time density are same, the space time is flat.

Figure 1 [11] shows that if these masses are super positioned, the points 1 to 9 look like a curve.

For each flat space, the point is different depending upon distance "d" in **Figure 1** it is a1 or 1j.

At this point, two forces will be acted in opposite direction and it gives velocity to any mass placed at this point. The difference between these two velocities is zero for a flat space. If it is not flat, the difference creates a curvature for distance "d" in order to keep the density with the mass which is associated to it. The curvature is proportional to stress energy tensor or momentum to move any matter on that curvature. The velocity created by the net force on that matter represents curvature. The curvature is proportional to stress energy tensor and the proportionality constant is Einstein's gravitational constant κ.

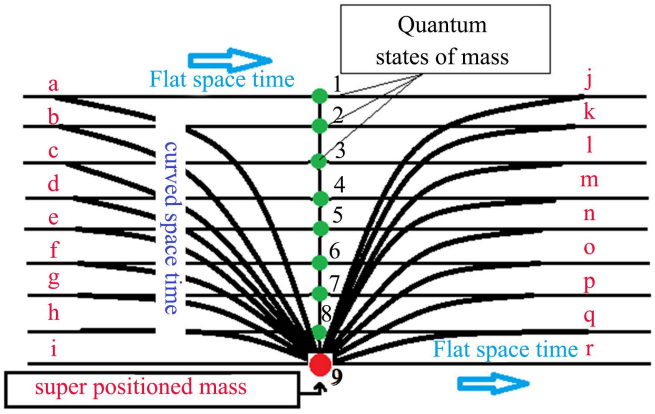

Figure 1. The planes a1j to i9r represent flat space times. Points 1 to 9 marked in green represent positional quantum states of mass. Curves a9 to h9 in left portion and j9 to q9 represent curvature of space time when 1 to 9 quantum states super positioned at 9 (If another point is considered, the curvature of space time will be changed accordingly). In any flat space time for example a1j plane, particle or energy density defined for that plane at 1 is the maximum velocity and will be used as signal velocity for relativistic transformations like a photon with light velocity defined for our four dimensional space time in which the curvature represents gravitational force.

Mathematically,

$$V_E - V_C = \kappa \tag{5}$$

$$Hd - \frac{K}{d} = \kappa \tag{6}$$

$$Hd^2 - \kappa d - K = 0 \tag{7}$$

$$d = \frac{\kappa \pm \sqrt{\kappa^2 + 4HK}}{2H} \tag{8}$$

We have

Einstein's gravity constant $\kappa = \frac{8\pi G}{c^4} = 2.077 \times 10^{-43}$ N.

[10] Hubble's constant $H = 4.1394908592 \times 10^{-19}\ \text{sec}^{-1}$.

[10] constant $K = 4.84533 \times 10^{-27}\ \text{m}^2 \cdot \text{s}^{-2}$.

Substitute these values in (8)

$$d = \frac{\kappa \pm \sqrt{\kappa^2 + 4HK}}{2H}$$

Since κ value is negligible comparing with the term $4HK$

$$d = \pm\sqrt{\frac{4HK}{4H^2}}$$

$$d = \pm\sqrt{\frac{K}{H}} \tag{9}$$

2.2. Constant "*K*" in Terms of Planck's Parameters [9]

$$cd^2 = Gt_p m \tag{10}$$

$$d = \text{planck length} = l_p$$

$$m = \text{planck mass} = m_p$$

$$c^2 l_p = Gm_p \quad \left(\because \frac{l_p}{t_p} = c\right)$$

$$c^2 l_p = Gm_p$$

$$\therefore l_p = \frac{Gm_p}{c^2}$$

$$c^2 t_p = K \quad \left(\because K = Gt_p\left(\frac{m}{l_p}\right)\right) \tag{11}$$

We know $l_p = \frac{K}{c}$.

And $t_p = \frac{K}{c^2}$.

$$m_p = \frac{Kc}{G} \quad \left[\because K = Gt_p\left(\frac{m}{l_p}\right)\right]$$

As per Planck scale,

$$m_p = \sqrt{\frac{\hbar c}{G}}$$

$$\therefore \sqrt{\frac{\hbar c}{G}} = \frac{Kc}{G}$$

$$\therefore K = \sqrt{\frac{\hbar G}{c}} \tag{12}$$

The constant "K" derived in (12) must be associated to Planck hole in quantum mechanics.

So, if we consider the synchronization of general relativity and quantum mechanics, K value which is in terms of Planck parameters in (12) can be substituted in (9). Constants "K" and "H" in (9) are associated to outer space time only.

2.3. Synchronization of GR & QM in Terms of Constant "K"

As shown in Figure 2, this diameter of outer space time contracted to another space time. The outer space time diameter "d" is different and inner space time diameter "d" is different. But from the basic principle, quantum mechanics and general relativity must be same. Outer space time represents general relativity and inner represents quantum mechanics. Both must be same. So, parameters will be changed to synchronize both the space times.

Say outer space time is attributed to general relativity for which parameter denoted by suffix "g" and for space time of quantum mechanics denoted by suffix "q".

The parameters are:

K_g, H_g, d_g, G_g, $\hbar_g$ and c_g, inside space time are K_q, H_q, d_o, G_q, $\hbar_q$ and c_q.

(9) can be written as

$$\therefore d_g = \sqrt{\frac{K_g}{H_g}} \tag{13}$$

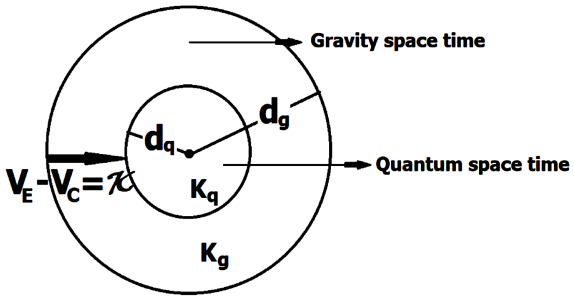

Figure 2. Net force on the body due to expansion and contraction nature of space time represented by Equation (5). The net force contracts the gravity space time in to quantum space time represented by arrow. Inner circle represents quantum space time for which the constant K_q. The outer circle represents gravity space time with K_g. Gravity space time with K_g will have space time diameter d_g and quantum space time contains space time diameter d_q. Parameters for gravity space time are K_g, H_g, d_g, G_g, $\hbar_g$ and c_g, and for quantum space time are K_q, H_q, d_o, G_q, $\hbar_q$ and c_q. Synchronization represented by Equation (15).

And (12) can be written as

$$K_q = \sqrt{\frac{\hbar_q G_q}{c_q}} \tag{14}$$

Now substitute K_g of (13) in (14) to make $d_g = d_q$,

$$\therefore d_g = \sqrt{\frac{\hbar_q G_q}{c_q H_g^2}} \tag{15}$$

If we apply it to hydrogen atom, the lowest state electron, is related to fine structure constant which is

d_g = diameter of Hydrogen atom [12] = $1.0583544213 \times 10^{-10}$ mt.

H_g is theoretical value of Hubble's constant [10] $4.1394908592 \times 10^{-19}$ sec^{-1}.

Its K_q is the space time constant for graviton and follows Equation (9)

$$\therefore d_g = \sqrt{\frac{K_q}{H_g}} \tag{16}$$

Here, both diameter of hydrogen atom d_g and the theoretical value of Hubble's constant H_g are with respect to our four-dimensional space time in which curvature is gravity and space time forms a quantum particle with space time diameter of graviton.

Instead of graviton, if we take any other fundamental force particle which is interpreted in terms of space time diameter, the gravitational constant "G" will be changed and other parameters like velocity of light "c" and reduced Planck constant $\hbar$ will be unchanged. It implies that the space time curvature will be changed. Graviton interprets the force of gravity as space time curvature.

In [10] diameter of hydrogen atom considered because, it is related to fine structure constant and is used in calculating space time diameters of fundamental forces as shown in **Table 1**. It is a modified Table from [13].

Table 1. Values of constant "K" for all fundamental forces including dark matter force.

S. No.	Fundamental force	Coupling constant As per standard model (α_s)	Coupling constant with respect to Electromagnetic force (α_p)	Space time diameter "d" as per equation $d_x^4 = 2.116991 \times 10^{-77} \times \alpha_x^3$ (mts)	Constant "K" as per equation $cd = K$ (sqmt/sec)
1	Strong Force	1	137	2.716253×10^{-18}	8.143122×10^{-10}
2	Electromagnetic force	$\frac{1}{137}$	1	$6{,}783124 \times 10^{-20}$	2.033529×10^{-11}
3	Weak interaction	10^{-6}	1.37×10^{-4}	8.58955×10^{-23}	2.5751×10^{-14}
4.	Dark Matter force	$1.0782272139 \times 10^{-23}$	$1.4771712831 \times 10^{-21}$	1.616229×10^{-35}	$4.845332646 \times 10^{-27}$
5	Gravitation	1.016788×10^{-39}	1.393×10^{-37}	$1.5466374059 \times 10^{-47}$	4.636702×10^{-39}
6	Bio-force	$6.3995777 \times 10^{-40}$	$8.7674215287 \times 10^{-38}$	$1.09290816 \times 10^{-47}$	$3.276456237 \times 10^{-39}$

Space time diameter for photon [13] is 6.783124×10^{-20} mt.

Space time diameter for graviton [13] is $1.5466374059 \times 10^{-47}$ mt.

Planck diameter [12] is in between these two. 1.616229×10^{-35} mt.

Planck diameter is also a space time diameter as per definition. So, there must exist a fundamental force. Its force carrying particle is interpreted by space time diameter equal to Planck length *i.e.*, 1.616229×10^{-35} mt.

3. Dark Matter as a Fundamental Force Particle

3.1. Coupling Constant for Dark Matter Particle

We have an equation relating coupling constant and space time diameter [13]

$$d_x^4 = 2.116991 \times 10^{-77} \times \alpha_x^3 \tag{17}$$

where d_x is space time diameter of any fundamental force and α_x is coupling constant of that force.

For $d =$ planck length $l_p = 1.616229 \times 10^{-35}$ mt the coupling constant is

$$\alpha = 1.4771712831 \times 10^{-21} \tag{18}$$

We can rewrite it as

$$\alpha_p = 1.4771712831 \times 10^{-21} \tag{19}$$

Since the calculation in the equation is with respect to photon.

With respect to standard model (Ref: **Table 1**)

$$\alpha_s = 1.0782272139 \times 10^{-23} \tag{20}$$

3.2. Mass of Dark Matter Particle

Since it is a fundamental force particle, it must be a flat space time with space time diameter equal to Planck length *i.e.* $d = l_p = 1.616229 \times 10^{-35}$ mt .

We have Equation (3)

$$m = 7.9905778 \times 10^{-17} \times d^{1/3}$$

$$\therefore m = 2.0202842713 \times 10^{-28} \text{ kg}$$

$$\therefore m = 1.1332939758 \times 10^{2} \text{ MeV}/c^2$$

$$\therefore m = 113 \text{ MeV}/c^2$$

$$(\because 1 \text{ eV} = 1.6021766208 \times 10^{-19} \text{ and } c = 2.99792458 \times 10^{8}) \text{ [12]}$$

Thus, there may exist a new fundamental force and its force carrying particle. Since it is a fundamental force particle, it must be a Planck hole in that space time. Therefore, it is a black hole in that space time with zero rest mass with respect to our space time. It is a primordial black hole with space time diameter. Since its space time diameter is less than photon's space time diameter, it cannot interact with photon. But, if we review the process of expansion [10], the density of matter in the universe is continuous and the expansion will be compensated by creation of matter and the density of matter is constant and the universe in steady state. Since space time diameter of photon is more than dark matter, prior

to interaction with photon, dark matter particles will interact as the time flows. Finally, it comes out as a photon and the continuous creation of these photons and dark matter create matter and energy continuously and compensate the expansion. Thus, dark energy is a phenomenal effect of expansion [10] and matter creation is quantum effect of space time to form dark matter. Finally, we can say the continuous creation of matter is an effect of synchronization of general relativity with quantum mechanics.

Dark matter concept is still a matter of discussion for lot of theoretical and observational astrophysicists and general relativists. MOND theories [14] and concerned experiments [15] suggested to modify Newtonian mechanics and equations for calculation of abnormal gravity regions. But my paper straight away denies that direction of thought since the paper proposed that the dark matter is a fundamental force carrying particle. Every such fundamental force is associated to a separate space time than our four-dimensional space time. Thus, every space time contains a separate signal with maximum velocity. In that space time, it contains a space time diameter and will be considered as zero space for transformations similar to photon in our space time. Thus, for fundamental force of dark matter, the space time diameter is Planck diameter. With respect to our space time, it is a black hole. It can be said as primordial black hole [16] but confined to Planck size only since they are part of continuous creation of matter and exist at any stage of universe [10]. My theory directly considers it as a quantum particle. I have explained that how fundamental force particles linked with space time diameter in previous papers [13]. If it is a black hole, even general relativity or modified Newtonian mechanics are also not enough to explain the singularity point. Thus, my approach is completely different and emphasizes that dark matter is a fundamental force carrying particle.

Few physicists considered the dark matter as a fundamental particle like a gauge boson [17]. Their results show that the mass of dark matter as a gauge boson is $\cong 17\ \text{MeV}/c^2$. In this paper, the mass is calculated as $113\ \text{MeV}/c^2$. Some more research in this direction may advance the science of dark matter for a fruitful experimental verification. The paper [18] also explained various attempts for detection of dark matter particle.

4. Conclusions

1) Einstein's general relativity field equation has been interpreted in terms of a constant "K" of space time ontology and is interpreted by equation $d = \sqrt{\frac{K}{H}}$. Planck scale of quantum mechanics interpreted K in terms of Planck parameters expressed by equation $K = \sqrt{\frac{\hbar G}{c}}$. In order to synchronize both quantum mechanics and general relativity, both the equations have been solved. Synchronization of general relativity and quantum mechanics interpreted by equation $d_g = \sqrt{\frac{\hbar_q G_q}{c_q H_g^2}}$.

2) It emphasizes that a space time of general relativity can explain all the fundamental forces of nature interpreted by quantum mechanics. Graviton and photon are fundamental force particles which can be interpreted by space time diameters. In between these two space time diameters, there exists a space time diameter with Planck length. Since it a space time diameter, there is a possibility that it is also a fundamental force particle. Thus, the paper emphasized the possibility of existence of a "fundamental force of nature" with a "force carrying particle" whose space time diameter is equal to Planck length. Its mass and coupling constant have been calculated as 113 MeV/c^2 and 1.08×10^{-23}. Thus, it is concluded that the dark matter is an elementary particle associated to a new fundamental force. Continuous creation of matter in the universe to compensate its expansion is an effect of synchronization of general relativity with quantum mechanics.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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