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Graviton and cosmology equations, before the Big Bang

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Abstract:

For long time seemed the Friedmann equation is able to explain universe, but in recent years, the cosmological constant was of interest to cosmologists. However, these two equations are unable to explain before the Big Bang. Thus this paper, from a new approach, turns out to merge the fundamental principles of quantum physics, relativity and classical mechanics through a new definition of rest state of particles like photon, and attempts to present the reasons and the possibilities of the existence of the superluminal speeds. So according to this new view some complex concepts and unanswered questions is explained in this paper.

Keyword: sub quantum energy, graviton, photon, relativity, negative and positive virtual photon, Friedmann equation, Big Bang

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Introduction

Cosmology attempts to describe the behavior of the entire universe using these physical laws. In applying these laws to the universe one immediately encounters a problem. What is the initial state that the laws should be applied to? In practice, cosmologists tend to work backwards by using the observed properties of the universe now to understand what it was like at earlier times. This approach has proved very successful. However it has led cosmologists back to the question of the initial conditions.

According to general relativity, the initial state of the universe, at the beginning of the Big Bang, was a singularity (with infinite density and zero volume). Both general relativity and quantum mechanics break down in describing the Big Bang. Despite its successes, the standard big bang theory was too simple to be complete. The Inflation Theory proposes a period of extremely rapid (exponential) expansion of the universe during its first few moments. It was developed around 1980 to explain several puzzles with the standard Big Bang theory, in which the universe expands relatively gradually throughout its history [1, 2, and 3]. My question is, if the universe collapses, will it reach to infinite density and zero volume? Or is there a force that will counteract it? That I have answered in this paper, according to reconsidering relativistic Newton's second law, the Big Bang is explained. Regarding the sub quantum energy, the Friedmann equation is reviewed.

In this paper, singularity have been considered and analyzed. This review can be a step to combine general relativity and quantum mechanics.

Theoretical formalism of reviewing

In reviewing graviton and Newton's second law, I have presented the new definition of graviton as follows [4]:

Graviton principle: graviton is the most minuscule unit of energy with constant NR mass m_G that moves with a constant magnitude of speed so that $|V_G| > |c|$, in all inertial reference frames. Any interaction between graviton and other existing particles represents a moment of inertia **I** where the magnitude of V_G remains constant and never changes.Therefore;

$$\nabla V_G = 0 \text{ , in all inertial reference frame and any space} \qquad (1)$$

Based on the principle of graviton, a graviton carries two types of energy generated by its movement in inertial reference frame. One is transmission energy and the other one is non-transmission energy. In physics, we represent energy summation (both kinetic and potential) by a Hamiltonian equation and energy difference by a LaGrangian. Therefore, in the case of graviton, we use a Hamiltonian to describe the summation of energy generated by transmission energy T and non-transmission energy S as follows:

$$E_G = T + S \qquad (2)$$

Since the speed and mass of graviton are constant, then $E_G = constant$.

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Sub-Quantum Energy

According to the principles of modern physics, Sub-quantum energy (SQE) is preferred and defined in a way that it could be generalized and by using it, quantum and relativistic phenomena could be explained [4].

Definition: Sub-quantum energy is the least electromagnetic energy that is defined as below:

$$SQE = h\nu_{least,}\ \nu_{least} < \nu, \forall\ E = h\nu, where\ E = h\nu\ is\ detectable \qquad (3)$$

Relation (3) shows *SQE* in terms of energy. Every other photon consists of some *SQE*, so that;

$$E = nSQE,\ where\ n\ is\ an\ integer \qquad (4)$$

$$E = nSQE = nm_{SQE}c^2 = n(m_{SQE}c)c = np_{SQE}c\ \Rightarrow E = np_{SQE}c \qquad (5)$$

For two photons with energies E_1 and E_2 we have:

$$E_2 = h\nu_2 = n_2SQE, E_1 = h\nu_1 = n_1SQE, E_2 > E_1\ \Rightarrow\ n_2 > n_1, n \propto \nu \qquad (6)$$

There $n_1$and n_2 are integers.

With increasing a photon's energy, its frequency also increases. Thus there should be a logical explanation between energy increase and frequency increase. Therefore, based on *SQE* definition and relation (6) we can relate the relation between photon's energy and frequency and the interaction between *SQE*s in a photon's structure, i.e. with increasing the number of *SQE*s in photons, the interaction between *SQE*s in photons will increase and the frequency that originates from the interaction between *SQE*s will increase too.

Note: Although $n \propto \nu$, this proportion does not necessarily represent an equation, but simply represents the physical fact that frequency has direct relation with the number and interaction of *SQE*s in a photon. Besides the relation between *SQE*s and ν, could conclude that the linear speed of *SQE* in a vacuum relative to the inertial frames of reference, is actually the speed of light c. Since *SQE* in a photon's structure has a linear speed equal to c and also it has nonlinear motions, the real speed of *SQE* is when all *SQE* nonlinear motions turn into linear motion and it only takes linear motion. In other words the limit speed of *SQE* is V_{SQE}which is faster than light speed c, i.e. $|V_{SQE}| > |c|$.

Consider that in special relativity the light speed is constant, and in general relativity besides increasing of photon frequency while falling in a gravitational field, its speed also increases (relation 4); that we could take it as a proof of $|V_{SQE}| > |c|$.

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Sub-Quantum Energy Principle

One *SQE* is a very small energy with *NR* mass m_{SQE} that moves at $|V_{SQE}| > |c|$ relative to inertial reference frame and in every interaction between *SQE*s with other particles or fields the speed value of *SQE* remains constant; as in every physical condition we have;

$$\nabla V_{SQE} = 0 \text{ , in all inertial reference frames and any space} \qquad (7)$$

SQE principle shows that in every condition the speed value of *SQE* remains constant and only the linear speed of *SQE* converts to nonlinear speed and vice versa. Considering the definition of *SQE*, every photon consists of some *SQE*, if we ignore the zero rest mass of photon, much better and more real, physical phenomena may be investigated. Thus, a photon with energy *E* has mass $m = E/c^2$ and a linear momentum $\mathbf{p} = \mathbf{mc}$. In other words, a photon is a part of matter and has nonzero mass before creation that after converting to photon carries the same mass that had in the matter and after absorption by a particle (e.g. an electron) the mass of photon is added to the mass of the particle. According the definitions of graviton, *SQE* and photon we can write;

$$|V_G| > |V_{SQE}| > |c| > |V_{particles}| \qquad (8)$$

So the constancy speed of light is a law [4].

Beyond the Friedmann Equation

The Einstein universe is one of Friedmann's solutions to Einstein's field equation for dust with density ρ, cosmological constant Λ_E, and radius of curvature R_E. It is the only non-trivial static solution to Friedmann's equations. The key idea is that the universe is expanding. Consequently, the universe was denser and hotter in the past. Also the big bang cannot be described using any known equations of physics until 10^{-6} seconds had elapsed. In this section we are using the sub quantum energy form of Friedmann equation; the inflationary Big Bang theory is reviewed.

A static universe is a cosmological model in which the universe is both spatially infinite and temporally infinite, and space is neither expanding nor contracting. Such a universe does not have spatial curvature; that is to say that it is 'flat'. A static infinite universe was first proposed by Giordano Bruno [5]. In contrast to this model, Albert Einstein proposed a temporally infinite but spatially finite model as his preferred cosmology in 1917, in his paper cosmological considerations in the General Theory of Relativity. Einstein wrote in his 1931 paper [6]; “In my original investigation, we proceeded from the following assumptions:

1. All locations in the universe are equivalent; in particular the locally averaged density of stellar matter should therefore be the same everywhere.

2. Spatial structure and density should be constant over time.”

The Einstein cosmological equation may be written in the form:

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$$R_{\mu v} - \frac{1}{2} g_{\mu v} R + g_{\mu v} \Lambda = \frac{8\pi G}{c^4} T_{\mu v} \qquad (9)$$

Where $R_{\mu v}$ is the Ricci curvature tensor, R is the scalar curvature, $g_{\mu v}$ is the metric tensor, Λ is the cosmological constant, G is Newton's gravitational constant, c is the speed of light in vacuum, and $T_{\mu v}$ is the stress–energy tensor.

Einstein's static universe is closed and contains uniform dust and a positive cosmological constant with value precisely $\Lambda_E = 4\pi G\rho/c^2$, where ρ is the energy density of the matter in the universe and c is the speed of light. The radius of curvature of space of the Einstein universe is equal to:

$$R_E = \frac{c}{\sqrt{4\pi G\rho}} \qquad (10)$$

Now let's review the Friedmann equation which is in the heart of the standard model of cosmology. We will deal with the original equation;

$$\left(H^2 - \frac{8}{3}\pi G\rho\right) R^2 = -kc^2 \qquad (11)$$

$$\left[\left(\frac{1}{R}\frac{dR}{dt}\right)^2 - \frac{8}{3}\pi G\rho\right] R^2 = -kc^2 \qquad (12)$$

Where $H = (\frac{1}{R})\frac{dR}{dt}$ is Hubble "constant", G is the gravitational constant , ρ is the universe mass density , c the speed of light and the parameter k is 0 , +1 or -1 . One can write $\rho = \rho_0(R_0/R)^3$, where ρ_0 and R_0 are the present day values of the density and radius of the universe.

In special relativity the speed of light in a vacuum is the same for all observers, regardless of the motion of the light source. But in the presence of gravity the speed of light becomes relative. Contrary to special relativity, the measured speed of light in a gravitational field is not constant, but these variations depend upon the reference frame of the observer; what one observer sees as true another observer sees as false. However, the speed of light in general relativity is not constant [7], and relation (12) is propounded for real space.

In addition, in quantum field theory, the vacuum state is the quantum state with the lowest possible energy. The uncertainty principle requires every physical system to have a zero-point energy greater than the minimum of its classical potential well. Also under the terms of *SQE* (sub quantum energy), any space that has the gravitational effects can produce electromagnetic energy. Look at the principle of sub quantum energy, and this fact that $|V_{SQE}| > |c|$, it means;

$$(\mathrm{v}_{SQE})_x + (\mathrm{v}_{SQE})_y + (\mathrm{v}_{SQE})_z = V_{SQE} = constant \qquad (13)$$

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In the inertial system we show v_{SQE} as the total transmission speeds rate and S_{SQE} the total non-transmission speeds rate of a *SQE*, so will always have;

$$v_{SQE} + S_{SQE} = V_{SQE} \qquad (14)$$

Thus, according to the direction of external force which was affected on a particle/object, the total non-transmission speeds rate is converted to the transmission speeds or to the inverse. Now we can define an absolute black hole. But before explanations, it is necessary to describe a few terms;

1- ***Sub quantum Divergence:*** if a particle/object falls in the gravitational toward a massive body, and the linear speed of its *SQE*s will be V_{SQE}, we say that the object has sub quantum divergence (Fig1). There is $v_{SQE} = V_{SQE}$ in the sub quantum divergence. So;

$$Sub-quantum\ Divergence;\ \ S_{SQE} = 0\ \rightarrow\ \ v_{SQE} = V_{SQE} \qquad (15)$$

2- ***Sub quantum Convergence:*** if total transmission speeds *SQE*s of a particle/object go to zero, $v_{SQE} \rightarrow 0$, we say that the object has sub quantum convergence (Fig1). There is $S_{SQE} \rightarrow V_{SQE}$ in the sub quantum convergence. So;

$$Sub-quantum\ Convergence;\ \ v_{SQE} \rightarrow 0, then\ \ S_{SQE} \rightarrow V_{SQE} \qquad (16)$$

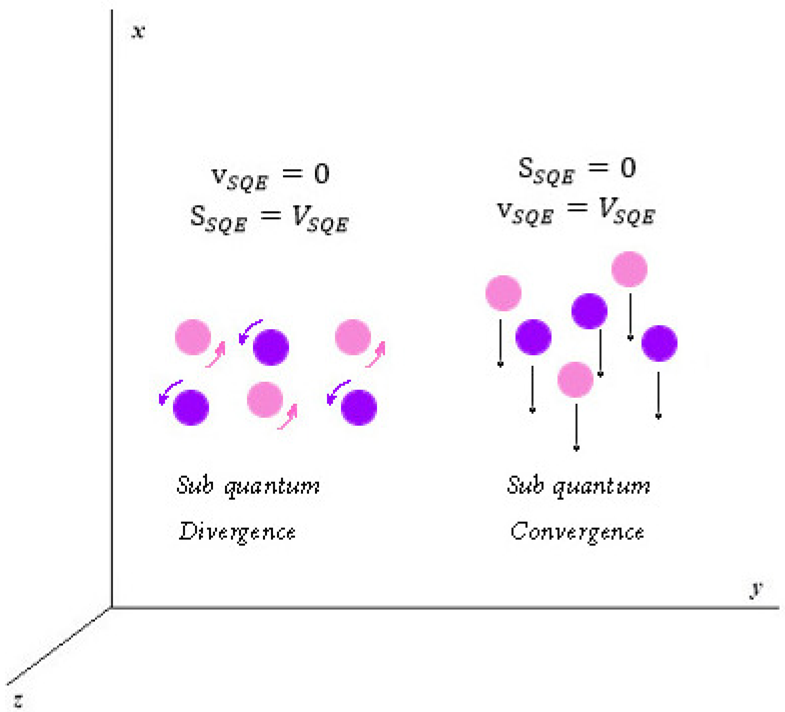

Fig1; Sub-quantum Divergence and Convergence

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Definition of an absolute black hole: If a particle/object falls down into the absolute black hole, it will be involved in sub quantum divergence before reaching the surface of the absolute black hole.

Consider the absolute black hole swallowing more matter; its mass and thus its gravitational field intensity will be increase. By increasing the mass, volume is reducing, its constituent *SQEs* are condensed and its transitional space will be limited.

Definition of Singularity: An absolute black hole with very high density under two followed conditions reaches the singularity state [8]:

1) Its constituent *SQEs* reach sub quantum convergence state i.e. $S_{SQE} \to V_{SQE}$. So the linear speed of everything on the surface of absolute black hole goes to zero, $\mathrm{v}_{SQE} \to 0$
2) Due to the gravitational pressure, the average distance between *SQEs* of an absolute black hole goes to zero.

Once the speed of *SQE*s reach $S_{SQE} \to V_{SQE}$, the average distance goes to zero due to intensive collision.

They are scattered around and these chain scattering are spread everywhere inside the absolute black hole and therefore the singularity is occurred. The density is very high in the singularity state, but not infinite. In addition, the volume does not reach to zero, but the average the distance between *SQEs* reach to zero. Given above descriptions can easily explain counteracting Newton's second law and gravity [9].

Given the above themes, there are three basic limitations: transmission speed, non-transmission speed and density that they are the reason of creation the observable universe and all physical phenomena existing in it.

Now, by using the relations (15) and (16), the Friedmann equation and then the Big Bang will be reviewed. So, the limit of linear speed in the universe is:

$$\mathrm{v}_{SQE} = V_{SQE} \qquad (17)$$

And the Friedmann equation (relation 12) can be written as follows [9]:

$$\left[\left(\frac{1}{R}\frac{dR}{dt}\right)^2 - \frac{8}{3}\pi G\rho\right] R^2 = -k\mathrm{v}_{SQE}^2 \qquad (18)$$

But there is $\mathrm{v}_{SQE} = 0$ and $S_{SQE} = V_{SQE}$ on the surface of absolute black hole at the moment of Big Bang [9]. So;

$$\left[\left(\frac{1}{R}\frac{dR}{dt}\right)^2 - \frac{8}{3}\pi G\rho\right] R^2 = 0 \qquad (19)$$

$$R^2 \neq 0 \Rightarrow \left(\frac{1}{R}\frac{dR}{dt}\right)^2 - \frac{8}{3}\pi G\rho = 0 \Rightarrow \left(\frac{1}{R}\frac{dR}{dt}\right)^2 = \frac{8}{3}\pi G\rho$$

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$$\frac{1}{R}\frac{dR}{dt} = \pm\sqrt{\frac{8}{3}\pi G\rho}$$

Let's ignore the minus part, so we can write:

$$\frac{dR}{R} = \sqrt{\frac{8}{3}\pi G\rho}\; dt$$

$$L_n R = \sqrt{\frac{8}{3}\pi G\rho}\; t + C\,, \qquad C\ is\ integer\ constant$$

$$R = e^{\sqrt{\frac{8}{3}\pi G\rho}\; t+C} = e^{C} e^{\sqrt{\frac{8}{3}\pi G\rho}\; t} \qquad (20)$$

For $t = 0$, it gives the initial universe radius R_0, $R_0 = e^C$, So;

$$R = R_0 e^{\sqrt{\frac{8}{3}\pi G\rho}\; t} \qquad (21)$$

Equation (21) is an exponential function that shows the rapid expansion of the universe in the early moments of Big Bang. According to the Big Bang, because Newton's second law counteracts gravity, the physical laws malfunction for moments, and after passing some time the physical laws will return to their normal conditions so the gravitons, also *SQE*s combine with each other and produce other particles, then Friedmann equation will be valid as follows:

$$\left[\left(\frac{1}{R}\frac{dR}{dt}\right)^2 - \frac{8}{3}\pi G\rho\right] R^2 = -k\mathrm{v}_{SQE}^2 \qquad (22)$$

It is considerable that |v| depends to external forces that act on *SQE*s, so that |v| might be greater or smaller than light speed c. This view might also be a step closer to solving a major riddle in modern physics.

Conclusion

Classical mechanics and relativity (special and general) describe the acceleration is an explanation of outward of phenomena regardless the properties of sub quantum scales. It should be noted that the interaction between large objects (e.g. collision of two bodies) under the action of the quantum layer (in fact sub quantum layer) done. In sub quantum level, the amount of speed is constant, in any condition and any space, and in any interaction linear momentum changes to nonlinear momentum and vice versa. According to *SQE*, we are able to show there is not a zero volume with infinite density in singularity also before the Big

Bang. So, regardless to reconsidering the relativistic Newton's second law [4], how can we resolve the dark energy problem?

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