The Mechanism of Graviton Exchange between Bodies, Part 1

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The Mechanism of Graviton Exchange between Bodies

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Abstract

In spite of publishing many articles about graviton, but it has not been done any considerable work about mechanism of graviton exchange between bodies/particles. The reason is that the old graviton definition (in modern physics) is unable to describe this mechanism and also it is impossible to get the theory of the quantum gravity .

In this article with re-considering physical phenomena, a new definition of graviton is given which by its using; the mechanism of graviton exchange between bodies/particle is described and surveyed.

The Mechanism of Graviton Exchange between Bodies

Introduction

Today the hottest problem in fundamental physics is quantum gravity. Quantum gravity was born in 1916, even before physicists had properly explained the other fundamental forces [1]. Gravitons are postulated because of the great success of quantum field theory (in particular, the Standard Model) at modeling the behavior of all other known forces of nature as being mediated by elementary particles: electromagnetism by the photon, the strong interaction by the gluons, and the weak interaction by the W and Z bosons. The hypothesis is that the gravitational interaction is likewise mediated by an elementary particle, dubbed the graviton. The graviton must be massless (because the gravitational force has unlimited range) and must have a spin of 2.

In the classical limit, the theory would reduce to general relativity and conform to Newton's law of gravitation in the weak-field limit. However, attempts to extend the Standard Model with graviton has run into serious theoretical difficulties at high energies (processes with energies close to or above the Planck scale) because of infinities arising due to quantum effects (in technical terms, gravitation is non-renormalizable). Since classical general relativity and quantum mechanics are incompatible at such energies, from a theoretical point of view the present situation is not tenable.

In this article we have focused on the law of conservation of mass-energy, especial the conversion gravitational potential energy to electromagnetic energy and vice versa.

First, by considering the interaction between gravity (in fact, graviton) and photon, we will find the properties of graviton, and by using the properties of graviton, we will redefine graviton.

Then according to the new definition of graviton, we will describe the mechanism graviton exchange between bodies/particles.

Newton and Einstein define the acceleration regardless of the structure of particles (in classical mechanics and relativity). This definition belongs to Newton era or macroscopic level. 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 level) has been done. Thus, according to quantum mechanics and mass–energy equivalence $E = mc^2$, we must redefine acceleration.

In other words, in quantum mechanics, we can generalize the concept of exchange particles or bosons, in this especial case by using graviton properties; we reconsider the concept of acceleration. For this reason, we focus on the left side of relation $E = mc^2$, and we reconsider and analyze the interaction between graviton and photon.

Note that the aim of this paper is to consider and describe the graviton exchange mechanism between the bodies. But the mechanism of graviton exchange between bodies must be compatible with the Newton's Second Law and the Universal Gravitational Law. In the other words, as graviton carrying gravitational force, it must be in accordance with the Newton's Second Law to change momentum, and consequently to change the energy of the bodies which causes the change of the acceleration. On the other hand, as the exchange of graviton cause changing the momentum and energy, therefore there are strong relation between gravitons (gravity) and photons (electromagnetic energy). That is why in this article, graviton is defined by using photon

(electromagnetic energy) (relation 5). Similarly, virtual photons are defined by using of gravitons (relation 19). Finally, the real photon can be defined according to the virtual photon (relation 20).

These relations, along with equations (9 and 10) describe the dependency and unity between gravity and electromagnetic. On the other hand, virtual photons carry electromagnetic forces and the graviton carries the forces of gravity. It means there are close relations between gravity and electromagnetic forces. Therefore, in order to understand and describe the mechanism of graviton exchange between the bodies, it is necessary to describe the mechanism of virtual photons production based on the charged particles.

Properties and speed of graviton

To redefine graviton, let's consider a photon that is falling in the gravitational field (blue-shift), and revert back to the behavior of a photon in the gravitational field. But when we define the graviton relative to the photon, it is necessary to explain the properties and behavior of photon in the gravitational field. During the photon is falling in the gravitational field, its energy (mass) increases. According to $W = \Delta mc^2$, the force of gravity performs work on the photon, so the mass (energy) of the photon and its frequency increase from ν to ν' that given by;

$$\nu' = \nu(1 + \frac{GM}{rc^2}) \qquad (1)$$

Similarly, redshift has the opposite effect that given by;

$$\nu' = \nu(1 - \frac{GM}{rc^2}) \qquad (2)$$

G is the gravitational constant; M is the mass of the body, c is the velocity of light, r is the distance from the mass center of body.

Also force is described as energy per distance that shown by:

$$F = -\frac{dU}{dx} \qquad (3)$$

The energy of photon depends on its electric and magnetic fields. Therefore, one part of the work done by gravity converts to electrical energy and the other part converts to magnetic energy. The change of frequency of the photon in the gravitational field has been demonstrated by the Pound-Rebka experiment, the result confirmed the predictions of general relativity [2]. How can we describe this interaction between photons and gravitons on a sub-quantum scale such as in the structure of a photon?

When gravity works on photon and gravitons enter the structure of photon, gravitons do change the intensity of electric and magnetic fields which belong to photon. So, gravitons behave so that they are carrying the charge and magnetic fields effects in the structure of photon. But photon has no electric effect. So, there should be two groups of gravitons one that behaves like electric field and the other one that neutralizes the electric effect of other group. So, a group of gravitons behaves like positive electric field and the other one behaves like negative electric field and they neutralize each other's electric effect. But they are moving, so a group of gravitons behave like magnetic field, and the intensity of two vertical electric and magnetic fields increases. So, gravitons are either color charge or color magnet. It shows a photon is made up of color charges and magnetic color that have linear speed equal c with photon motion and nonlinear speed in the structure of

photon, so, they move faster than light speed (Figure1). In the other word graviton moves faster than light speed [3].

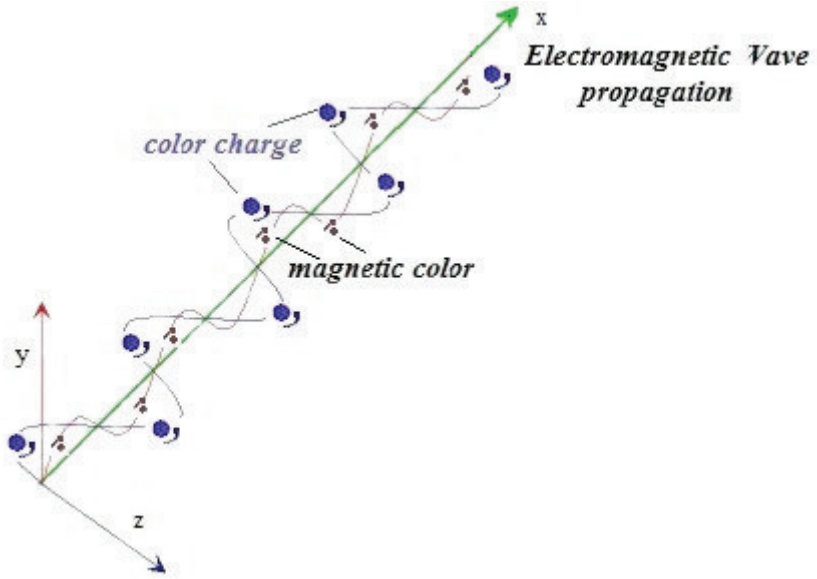

Fig1; paths of gravitons in photon structure, color charges and magnetic color have spin and curvature speed

It is important that we note the speed of graviton (also color charge and magnetic color) that is given with V_G and as explained before, its speed is faster than light speed, so $V_G > c$, that V_G is the total speed of linear and nonlinear of graviton or color charge and magnetic color. According to the above explanation and Figures (1) we can write;

$$V_{Gx} + V_{Gy} + V_{Gz} = V_G > c$$

And also note that as figure (1) shows we can write;

$$(V_{Gx} = c) + V_{Gy} + V_{Gz} = V_G > c \qquad (4)$$

As we know, some particles such as photons are never seen at rest in any reference frame. So, there are two kinds of particles in physics;

1- Some particles like the photon move only with the speed of light c, in all inertial reference frames. Let's call these kinds of particles the NR-particles or Never at Rest condition particles.

2- Other particles like the electron always move with the speed v $< c$ in all inertial reference frames; they have rest mass, and could be called particles.

According to the above definition, photon and graviton are NR-particles, while electron and proton are particles.

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Definition of graviton

A graviton is a NR-particle, with the constant NR mass m_G , that moves with the constant magnitude of speed of $|V_G| > |c|$ in any inertial reference frame, where c is the speed of light. According to the gravitational redshift, the NR mass of graviton is defined relative to a photon's NR mass by;

$$m_G < m = \frac{h\nu}{c^2} \quad \forall\, \nu \qquad (5)$$

And the relationship between energy and momentum for the NR mass of graviton given by;

$$\langle E_G \rangle = \langle |P_G| \rangle V_G = constant \qquad (6)$$

In all inertial reference frame and any condition

Relation (6) shows that the energy (also mass) of graviton is constant, in any interaction between gravitons or with other particles. The space is full of gravitons. While the density of gravitons increases in space, the distance between them decreases, but they do not attach to each other, their paths change without decreasing (or increasing) the magnitude of V_G.

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;

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

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_G and non-transmission energy S_G as follows:

$$E_G = T_G + S_G = constant \qquad (8)$$

Since the speed and mass of graviton are constant, then $E_G = constant$. Graviton produces energy and energy produces matter and anti-matter. In fact, everything has been formed of graviton.

Sub quantum energy and Maxwell equation

When a photon falls in a gravitational field as Δr, the graviton's density in the vicinity of the photon electric field changes the value of ∂G_E, because the intensity of electric field changes as $\boldsymbol{E}_G$ ($\boldsymbol{E}$ is the electric field arising from graviton). In fact gravitons enter the structure of photon, and the intensity of electrical and magnetic fields which depends on photon increases. Two types of gravitons should enter the photon structure, so that they are able to increase the intensity of

photon electric field without any charge effect. Thus the interaction between gravitons and photon, negative and positive $\boldsymbol{G^-}, \boldsymbol{G^+}$ gravitons (color-charges) are produced and enter the photon structure. The photon moves in the same direction as the increasing intensity of the gravitational field does, and the photon electric field is perpendicular to the photon movement direction that is compatible with the following equation:

$$\boldsymbol{\nabla} \times \boldsymbol{E}_G = -\frac{\partial \boldsymbol{G}_E}{\partial t} \Leftrightarrow i(\boldsymbol{G^+}, \boldsymbol{G^-}) \qquad (9)$$

By changing the photon electric field, magnetic field also changes [6]. In this case also, the gravitons are converted into magnetic carrier particles G_m^+, G_m^- and enter the structure of photon that is given by;

$$\boldsymbol{\nabla} \times \boldsymbol{B}_G = \mu_0 \varepsilon_0 \frac{\partial \boldsymbol{E}_G}{\partial t} \Leftrightarrow j(\boldsymbol{G_m^+}, \boldsymbol{G_m^-}) \qquad (10)$$

Where i, j are natural numbers, and proportion between i *and* j should be consistent with equation (page 34 of [4]). According to the above relations, we can define energy and mass of graviton and photon in relation with each other.

Sub Quantum energy (*SQE*) and Dirac equation

To explain and define sub quantum energy, it is necessary to analyze the Dirac equation, we will have:

$$E^2 = (mc^2)^2 \rightarrow E = \pm mc^2 \qquad (11)$$

In general state, equation (11) does not accept any limitation for mass and energy regarding its value. Moreover, in limit of zero mass (zero rest mass of particles in quantum mechanics conceptions), Dirac equation was reduced to Weyl equation [5]. Weyl equation predicted the existence of fermions that their rest mass is zero [6], but they have spin $\frac{1}{2}$. Because here, the aim is to investigate and recognize the structure of photon. We reduce β matrix (of Dirac equation [4]) as follows and now we call it matrix A until after computations and necessary conclusions, we choose a special notion for it:

$$A = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \qquad (12)$$

$$Amc^2 \rightarrow \begin{bmatrix} mc^2 & 0 \\ 0 & -mc^2 \end{bmatrix} \qquad (13)$$

According to relations (11 and 13) and in a special case that a photon collides with a heavy nucleus with at least energy $E = 1.022\ MeV$, we can write:

$$E_+ = mc^2, \quad E_- = -mc^2$$

That is called the process of pair production of electron and positron. Therefore, in general case, the relation (13) is reagent of energy for two fermions with spin $\frac{1}{2}$ that one of the possible case describes pair production of electron-positron. But occurring other cases is possible including photon with energy less than $E = 1.022\ MeV$ is decayed to two fermions with spin $\frac{1}{2}$, that move

with speed of light in which it is describer of Weyl fermions and they are called massless fermions or Weyl fermions (or particles with zero rest mass) [7 and 8].

According to gravitational red-shift and blue-shift, energy of a photon can decrease or increase without changing in its physical properties (except its energy and frequency). It means that whatever is increased to the energy of photon, it has the same total properties of photon (properties of electromagnetic energy). In other words, all photons have common physical properties except the value of energy that again it can be used the relation (13) for them. Therefore, at least electromagnetic energy can be defined as follows:

$$E_{minimum} = \frac{hc}{\lambda_{max}} \ , where\ E_{minimum}\ is\ detectable \qquad (14)$$

According to relation (12), $E_{minimum}$ includes two parts that it can be written as follows:

$$AE_{minimum} \rightarrow \begin{bmatrix} +\frac{E_{minimum}}{2} & 0 \\ 0 & -\frac{E_{minimum}}{2} \end{bmatrix} \qquad (15)$$

In relation (15), the minus sign does not imply being negative of energy (or negative mass), as positron is not negative energy or mass in pair production. Signs $+, -$ in relation (15) show electromagnetic fields around a charged particle and carry the same type of electromagnetic energy that there exists around a charged particle. Therefore, the photon is formed of two types of positive and negative sub quantum energies that we show them by operators, right wedge $\rhd$ for positive sub quantum energy and left wedge $\lhd$ that are defined as follows:

$$\text{Positive Sub Quantum Energy; } SQE^{+}: \rhd = +\frac{E_{minimum}}{2} \qquad (16)$$

$$\text{Negative Sub Quantum Energy; } SQE^{-}: \lhd = -\frac{E_{minimum}}{2} \qquad (17)$$

It is obvious that spin of sub quantum energy (SQE) is equal to $\frac{1}{2}$. In general case, relation (13) can be written by using the definition of positive and negative sub quantum energies $\rhd$, $\lhd$ in which k is a natural number and instead of A, we use γ that is sign or symbol of electromagnetic energy:

$$\gamma = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \qquad (18)$$

$$\gamma mc^2 \rightarrow \begin{bmatrix} k \rhd & 0 \\ 0 & k \lhd \end{bmatrix} \qquad (19)$$

In relation (19), $k \rhd$ is positive virtual photon γ^{+}, in which carries positive electric force and forms positive electric field and $k \lhd$ is negative virtual photon γ^{-} that carries negative electric force and forms negative electric field. Every real photon is formed of two virtual photons. Therefore, we will have:

$$\gamma^{+} = k \rhd,\ \gamma^{-} = k \lhd \rightarrow \gamma = \gamma^{+} + \gamma^{-} \qquad (20)$$

As charged particles absorb or repulse each other and are ineffective on neutral particles, homonymous virtual photons repulse each other, non-homonymous virtual photons absorb each other and they form quantum energies and it causes two non-homonymous charged particles

accelerate towards each other (page 40, [9]). Assume that $2k$ positive and negative color-charges (kG^+, kG^-) enter the very small part of photon structure, proportional to the number of color-charges, the number of magnetic-colors are produced around the color-charges. Two opposite electric field are created in this space. Around each of the electric field a magnetic field is created by magnetic-colors. According to the sign of the electric fields, direction of magnetic fields are different, each magnetic field cover its color-charges and prevents them of escaping (page 28, [9]). Each of the magnetic fields protects its electrical field and prevents them from collapsing. This mechanism is justifiable by Larmor radius (gyro radius or radius of the cyclotron) [10].

Sub-Quantum Energy (SQE) Principle

One *SQE* is a very small energy with mass m_{SQE} that moves with speed $|V_{SQE}| > |c|$ 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;

$$\nabla V_{SQE} = 0 \text{ , in all inertial reference frames and any space} \qquad (21)$$

SQE principle (equation 21) shows that in every condition the mass, energy and the amount speed of *SQE* remains constant, and only the transmission speed V_{SQET} and energy E_{SQET} of *SQE* convert to its non-transmission speed V_{SQES} and energy E_{SQES} , and vice versa. Therefore, we have;

$$|V_{SQE}| = |V_{SQET}| + |V_{SQES}| = constant \qquad (22)$$

$$|E_{SQE}| = |E_{SQET}| + |E_{SQES}| = constant \qquad (23)$$

Production of virtual photon

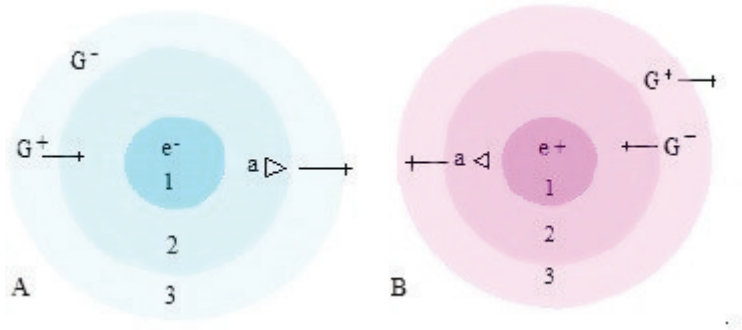
In quantum electrodynamics (QED) a charged particle emits exchange force particles continuously. This process has no effect on the properties of a charged particle such as its mass and charge. How is it explainable? In theoretically a pure steady state spin current without charge current can induce an electric field ([9] page 63). If a charged particle as a generator has an output known as a virtual photon, what will be its input? Now let's explain the mechanism of electrodynamics fields around the electron and positron.

Look at the electron and positron. Electron is in the center of a spherical space (Figure 2-A). This rotational sphere-like (electron spinning) is in a look into gravitons. The electron has two opposite interactions on gravitons around itself, and converts them to G^- , G^+, so there is a lot of G^- , G^+in area 3 (Figure 2-B) G^-s escape from electron's locality and G^+s move toward the electron and enter the area 2, near the magnetic field of electron spinning. Magnetic field (electron spinning) compresses positive gravitons G^+s and repels them.

Now we can define an operator for the production of positive electric force particle. Let's show this operator by $a \lhd$ per time that acts on the electron and produces positive electric force, it is given by;

$$\frac{d}{dt} \lhd s = a \rhd \qquad (24)$$

There, a is a natural number. Operator $\lhd s$ compresses G^+s and pushes them; a magnetic field which contains G^ms is formed up around G^+s set. According to the Larmor (cyclotron) radius can be prevented from scattering [10]. Each process in the laboratory is feasible, realistic and easier to occur in nature.



A. Electron; Area3, G convert to G^- , G^+, then G^- moves to far and G^+ moves to area2

Area2: Spinning electron, magnetic field compacts G^+s and repels virtual positive photon that shown by $a \rhd$

B. Positron; Area3, G convert to G^- , G^+, then G^+ moves to far and G^- moves to area2

Area2: Spinning positron, magnetic field compacts G^-s and repels virtual negative photon that shown by $a \lhd$

Fig2; around charged particles

Operator $\lhd s$ shows a magnetic field which presses the positive gravitons G^+s around electron (spinning electron) and makes a virtual positive particle of electric force continuously that we show by γ^+. In general, a charged particle is a generator that its input is gravitons and its output is virtual exchange particles that form the electric field. So, for electron we can write;

$$\frac{d}{dt} \lhd s(G^+) = a \rhd = \gamma^+ \qquad (25)$$

Same as electron, positron's behavior is like a generator, but spinning positron produces and emits negative virtual particles continuously. So;

$$\frac{d}{dt} \rhd s(G^-) = a \lhd = \gamma^- \qquad (26)$$

When $a \rhd = \gamma^+$ from the electron reaches to area2 around the positron, then it combines with $a \lhd = \gamma^-$ and they form a quantum energy, so that;

$$a \rhd + a \lhd = \gamma^+ + \gamma^- = \gamma \qquad (27)$$

This quantum energy is transferred to the positron, and positron accelerates toward the electron.

Note: With the discovery of charged particles and electric fields, it was assumed that the charged particle and the surrounding fields are the same. Our examination shows that the electron produces positive virtual photon, emits and pushes the negative charges, because each negative charged particle behaves on the other, the same as electron and produces positive virtual particle.

Likewise, positive charged particles such as positron, also provides a negative electric field that drives the positive virtual photon.

Graviton Exchange Mechanism

According to the previous section, the charged particles are producing positive and negative color-charge. Negative charged particle absorbs positive color-charges G^+ and produces and emits positive virtual photons γ^+, and repels negative color charges G^-. Also positive charged particle absorbs negative color-charges G^- and produces and emits negative virtual photons γ^-, and repels positive color charges G^+ . In addition, according to the law of conservation of electric charge, amount and number of positive and negative electric charges are equal, therefore, the amount and number of positive and negative color-charges is released in space are equal. So, space is full of positive and negative color-charges and normal graviton G , G^+ , G^-, they are released faster than speed of light in space (relation 4). Density of G , G^+ , G^- around objects is proportional to $1/r^2$, where r is the distance of the body.

According to the concepts of color-charges and magnetic-colors G^- , G^+, G_m , and negative and positive virtual photons γ^+, γ^- , it can be concluded that the Dirac equation is not only for the high-energy photon and pair production electron-positron, in fact Dirac Sea can be generalized to all of space [4]. This means that all objects / particles in the universe, are immersed in the Dirac Sea. In the previous section we saw that color-charges and magnetic-colors are combined and make positive and negative virtual photons. The amount of production of γ^+, γ^-, and their energies depend to density of graviton (in fact, density of G^- , G^+, G_m , G) in space and around the particles. As seen in figure 2, area 2 around any charged particle is the birthplace of virtual photons that carry the electromagnetic force, but in the area 3, positive and negative sub quantum energies $\triangleright$, $\triangleleft$ are created that make the gravitational potential energy. By comparing the ratio of the electromagnetic force and gravitational force between two electrons[1], as well as the energy of sub quantum energy $\triangleright$, $\triangleleft$ and energy of virtual photon γ^+, γ^- can be compared with each other (consider relation 3 that shows the relation between the force and energy).

Example 1: The stone starts out with a certain amount of kinetic energy, but as it climbs it slows down and its kinetic energy decreases. Its kinetic energy convert to sub quantum energies $\triangleright$, $\triangleleft$, and sub quantum energies convert to color-charges and magnetic colors and normal graviton G^- , G^+, G_m, G , (similar to gravitational red-shift). Until, at the top of its flight, the stone is momentarily at rest. On the way down, first gravitons convert to color-charges and magnetic-colors G^- , G^+, G_m , and they convert to sub quantum energies $\triangleright$, $\triangleleft$, then $\triangleright$, $\triangleleft$ combine and do form the kinetic energy. And in the end, in the collision stone with earth, sparks and heat are generated.

Example 2: According to CPH Theory, gravity is a currency among the objects. Consider the interaction between the earth and the moon: when a graviton reaches the earth, the other one moves toward the moon and pushes the earth toward the moon. Because as to maintain equality times - positive and negative color-charges, there is a fixed ratio between the mass and the number of gravitons surrounding. Also when a graviton reaches the moon, the other one moves toward the

[1] - The electromagnetic repulsion between the electrons is stronger than their gravitational attraction by a factor of over 10^{42}!

earth and pushes the moon toward the earth. So earth (In fact everything) is bombarded by gravitons continuously. Due to the fact that everything is made up of sub quantum energy, the classical concept of acceleration and relativistic Newton's second law needs to be reviewed [11].

Summary

To date there is no way to explain the process that describes how particles as photon absorb gravitons. We have studied years long the relationship between gravity and photon in the blue shift phenomena. According to the results of this research we can claim definitely say that there are a few fundamental problems in theoretical physics that causes all these efforts reach to fail. These problems barricade we monitor physical phenomena with the law of nature and not by our laws. We can separate our theories and laws for explaining macroscopic and microscopic phenomena, but nature does not. At the beginning of the 20th century, Newton's second law was corrected considering the limit speed c and the relativistic mass. If we ignore the zero rest mass and modify the relativistic Newton's second law, then much better and more real physical phenomena would be explainable. The speed of the created particles is a function of the internal interaction and the mechanism of creation of subatomic particles, and the external forces that are exerted on them. Quantum gravity using the gauge interaction of a spin-2 field for graviton fails to work the way that the photon and other gauge bosons do. Maxwell's equations always admit a spin-1, linear wave, but Einstein's equations rarely admit a spin-2, linear wave, and when they do it is not exact.

However, in the present article the photon is made of gravitons. To resolve this problem, according to gravitational blue-shift we need explain this process is using color-charges and magnetic-color concept that derived from quantum chromodynamics and photon properties for gravitons.

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