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Graviton and virtual photons

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Abstract:

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? If a charged particle as a generator has an output known as a virtual photon, what will be its input?

In this article, according to the experimental observations, I generalize the Maxwell equations of electromagnetism to the gravitational field. I have used the pair production and decay to show that a charged particle acts like a generator, the generator input and output are gravitons and virtual photon. The negative charged particle produces positive virtual photon and positive charged particle produces negative virtual photon. A negative and a positive virtual photon combine with each other in the vicinity of a charged particle and cause the charged particle to accelerate. Although this approach to Quantum Field Theory (QFT) is presented, it has some differences. The mechanism of negative and positive virtual photons interaction is easier and more realistic than exchange particles of QFT, and it also has no ambiguities of QFT. After all, I explain the real photon and its structure by using the virtual photons.

Keyword: graviton, photon, color charge, magnetism color, negative and positive virtual photon, Zero point energy

Graviton and virtual photons

Introduction

In quantum field theory, forces are transmitted by particles, and fields are associated with particles which transmit the forces. The particles of the electromagnetic field are the photons. In quantum electrodynamics all electromagnetic fields are associated with photons, and the interaction between the charged particles occurs when one charged particle emits a virtual photon that is then absorbed by another charged particle. The photon has to be a virtual photon, because emission of a real photon would violate energy and momentum conservation. If, for example, an electron initially at rest emitted a photon, the final state would consist of an electron and a photon moving off in opposite directions, a configuration which necessarily has more energy than the initial at-rest electron. But the uncertainty principle prevents a contradiction[i].

Zero-point energy, also called quantum vacuum zero-point energy, is the lowest possible energy that a quantum mechanical physical system may have; it is the energy of its ground state. All quantum mechanical systems undergo fluctuations even in their ground state and have associated zero-point energy, a consequence of their wave-like nature. The uncertainty principle requires every physical system to have a zero-point energy greater than the minimum of its classical potential as well. This results in motion even at absolute zero. If the zero point energy in space (vacuum) exists, how can we explain the zero-point energy without using the uncertainty principle?

If we carefully review a pair production and decay and the results of high energy particle collisions, from the relation E= mc2 this question will be raised whether in addition to being convertible of energy into mass and vice versa, the other concepts can be derived as well. Are there common rules in the energy structure and elementary particles? If we continue to believe that in the Standard Model, elementary particles are point particles and unstructured, we cannot resolve ambiguities in modern physics. This is our attempt to answer these questions.

Theoretical formalism of reviewing

In reviewing graviton and Newton's second law, I have presented the new definition of graviton as follows [1]:

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 $E_G = constant$.

The Photon in a gravitational field

Looking at the behavior of a photon in a gravitational field can help resolve vacuum energy. The fields around a "ray of light" are electromagnetic waves, not static fields. The electromagnetic field generated by a photon is much stronger than the associated gravitational field. During a photon is falling in a gravitational field, its energy (mass) increases. According to $= \Delta mc^2$, the force of gravity performs work on the photon, so the mass (energy) of the photon increases. Photon acquires energy equal to$W = \Delta mc^2$, which separates into three parts; one part behaves like a positive electric field and another part behaves like a negative electric field. These neutralize each other in the structure of the photon (a photon itself is neutral) and the third part behaves like a magnetic field.

In quantum mechanical theory, every field is quantized. In addition, force is described as energy per distance shown by:

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

If we consider this equation from the aspect of quantum mechanics, a graviton enters into the structure of a photon, carrying gravitational force. As a result, a graviton disappears and the energy of the photon increases. For identifying and understanding the mechanism of the gravitational blue-shift, and converting gravitational energy into electromagnetic energy and vice versa, we must use the equations of Maxwell's electromagnetic theory to explain gravitons.

When a photon in a gravitational field as Δr falls, 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 E_G (E is the electric field arising from gravitons). 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 G^-, G^+gravitons are produced and enter the photon structure. Let's call G^- negative color charge and G^+ positive color charge. 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:

$$\nabla \times E_G = -\frac{\partial G_E}{\partial t} \qquad (4)$$

By changing the photon electric field, magnetic field also changes. In this case also, the gravitons are converted into magnetic carrier particles G^m (that calls magnetic color) and enter the structure of photon that is given by;

$$\nabla \times B_G = \mu_0 \varepsilon_0 \frac{\partial E_G}{\partial t} \qquad (5)$$

Graviton and virtual photons

Assume 2n color charges (nG^+, nG^-) combine and move in a cutoff of space. There are two electric fields with opposite sign in this cutoff of space. Around each of these electric fields a magnetic field forms, produced by gravitons. According to the signs of these fields, the directions of these magnetisms are different, so their elements are same. Therefore, when the intensity of color charges grows, around each field (negative and positive fields) a magnetic field forms. This magnetic field maintains the electric field. This mechanism is explainable by the Larmor radius (gyroradius or cyclotron radius) [2] that is given by:

$$r_{\mathrm{g}} = \frac{m\mathrm{v}_{\perp}}{|\mathrm{q}|\mathrm{B}} \qquad (6)$$

Where r_{g} is the gyroradius, m is the mass of the charged particle, $\mathrm{v}_{\perp}$ is the velocity component perpendicular to the direction of the magnetic field, q is the charge of the particle, and B is the constant magnetic field.

This defines the radius of circular motion of a charged particle in the presence of a uniform magnetic field. When color charges change in the structure of a photon, magnetic color changes too. Therefore the electric fields do not decay in the structure of photon. In general, a photon has been formed of two parts;

1- A large number of negative color charges and magnetic color do form sub quantum energy *SQE* [1]. Magnetic color maintains color charges in a torus-like distribution, so negative magnetic color forms an appropriate negative electric field. In addition, the same happens for positive electric field in the opposite sense. So it is now possible to demonstrate the least possible negative color charges with their magnetic color shows by $\lhd$, so that;

$$Negative\ SQE; \lhd = (\kappa G^-, -G^m) \qquad (7)$$

2- Similarity to the above; positive color charges with their magnetic color can be shown by $\rhd$, so that;

$$Positive\ SQE; \rhd = (\kappa G^+, +G^m) \qquad (8)$$

Where κ is a natural number, and $\pm$ shows the direction of the magnetic field suitable of color charges. In fact, there is a kind of magnetic color in the structure of *SQE*s. Therefore, generally, negative and positive virtual photons are given by;

$$Positive\ virtual\ photon;\ k \rhd = \gamma^+ \qquad (9)$$

$$Negative\ virtual\ photon;\ k \lhd = \gamma^- \qquad (10)$$

A real photon is given by;

$$\gamma^+ + \gamma^- = \gamma \qquad (11)$$

$$(n \rhd + n \lhd) = n(\rhd + \lhd)\ or\ n|\rhd\rangle + n|\lhd\rangle = \gamma \qquad (12)$$

Where $k\ and\ n$ are natural numbers. Also around of $n \lhd,\ n \rhd$, the G^ms move in two different directions, magnetic field is a flow of G^ms without any starting point.

Equ (9, 10) indicate the process of converting gravitational energy to virtual electromagnetic energy (virtual photon). Equ (11, 12) also show process of converting virtual photon into real photon. The inverse of this process is gravitational redshift that *SQE*s leave the photon structure and convert to gravitons [3].

Gravitons move with linear speed c in the photon structure, and since they are also forming components of electric and magnetic fields, they have a non-linear speed. For simplicity, consider a photon is traveling in the x direction, or consider the direction of the photon as choosing the coordinate axis so that x points along the photon's momentum vector. Every element in the structure of photon (Equ 12) moves with linear speed c in the same direction as the photon and has non linear speed that is given by;

$$|\mathrm{v}_G|\ , |\mathrm{v}_{G^-}|, |\mathrm{v}_{G^+}|, |\mathrm{v}_{G^m}| > \left|V_{SQE}\right| > \ |c| \qquad (13)$$

Considering the relations (9) and (10) around of $k \lhd,\ k \rhd$, the G^ms move in two different directions, magnetic field is a flow of G^ms without any starting point. Relations (11) and (12) indicate the process of converting gravitational energy into electromagnetic energy. The inverse of this process is gravitational redshift that gravitons leave photon structure.

Zero point energy (ZPE)

This attitude can explain zero-point energy. Under the terms of *SQE*, any space that has the gravitational effects can produce electromagnetic energy, and here the photon in the conversion of gravitons into G^-, G^+, G^m, and electromagnetic energy acts only as a catalyzes. When intensity of gravitational field increases or interfere gravitational fields of two massive bodies that are moving adjacent each other, gravity produces the electromagnetic energy. In this case the relation (4) becomes as follows, but the relation (5) remains the same.

$$\nabla \times G_E = -\frac{\partial G}{\partial t} \qquad (14)$$

In equation (14), ∂G shows that even without the electric field, when density of gravitons increases, gravitons take the electrical properties. The energy produced in space is a function of the graviton's density changes in the space. If we suppose the variation in graviton's density in the sample space is $\rho_{\partial G}$, then integral on the volume V of space, will be equal to the electromagnetic energy that is given by;

$$E = \iiint_V \rho_{\partial G} dxdydz \qquad (15)$$

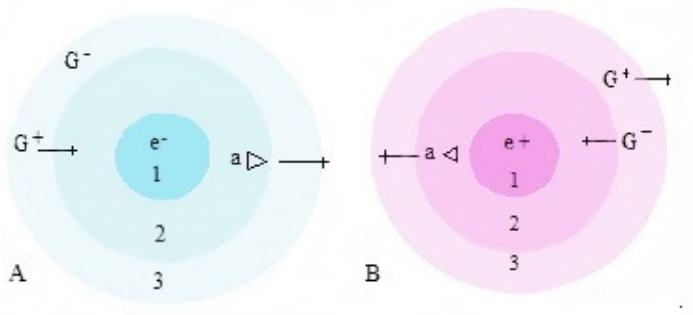
$$Gravitational\ energy \Leftrightarrow Electromagnetic\ energy \qquad (16)$$

Relations (4) and (5) have been completed by equation (15). Things mentioned above, are logical explanation for relation (16).

Graviton and virtual photons

Production of virtual photon

While the classical, wavelike behavior of light interference and diffraction has been easily observed in undergraduate laboratories for many years, explicit observation of the quantum nature of light (photon) is much more difficult. For example, while well-known phenomena such as the photoelectric effect and Compton scattering strongly suggest the existence of photons, they are not definitive proof of their existence [4].



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 $a \lhd$

Fig1; around charged particles

However, in particle physics, quantum field theories such as the Standard Model describe nature in terms of fields. Each field has a complementary description as the set of particles of a particular type. A force between two particles can be described either as the action of a force field generated by one particle on the other, or in terms of the exchange of virtual force carrier particles between them. The energy of a wave in a field (for example, electromagnetic waves in the electromagnetic field) is quantized, and the quantum excitations of the field can be interpreted as particles. 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 [5]. 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 1-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 1-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.

Graviton and virtual photons

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;

$$\frac{d}{dt} \lhd s = a \rhd \qquad (17)$$

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 [6]. Each process in the laboratory is feasible, realistic and easier to occur in nature.

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;

$$\frac{d}{dt} \lhd s(G^+) = a \rhd = \gamma^+ \qquad (18)$$

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

$$\frac{d}{dt} \rhd s(G^-) = a \lhd = \gamma^- \qquad (19)$$

When $a \rhd = \gamma^+$ from the electron reaches to area2 around the positron, it combines with $a \lhd = \gamma^-$ and they form a quantum energy (figure 2), so that;

$$a \rhd + a \lhd = \gamma^+ + \gamma^-$$

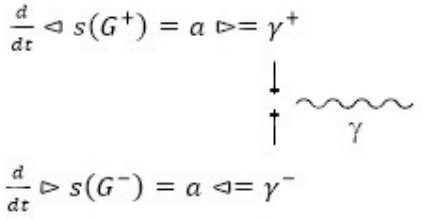


Fig2; virtual photons and real photon

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.

Conclusion:

To date, there is no way to explain the process that describes how particles produce exchange particles in modern physics. According to the results of reconsidering relativistic Newton's second law, we can definitely say that the best way for unifying the interactions is generalizing interaction between charged particles to photon structure and vice versa. This new view on photon means that we can redefine the graviton and electromagnetic energy. Electromagnetic energy converts to matter and anti-matter such as charged particles. Charged particles use gravitons and generate electromagnetic field. This way of looking at the problem shows how two same charged particles repel each other in far distance and absorb each other at a very small distance.

Attention to photon structure and using new definitions for graviton, charged and exchange particles, will change our perspective on modern physics. It also provides us with a new tool to be able to overcome physics problems in a better way. This approach will show us how particles are formed.

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