

# Interactions Between Real and Virtual Spacetimes

H. Javadi<sup>1\*</sup>, F. Forouzbakhsh<sup>2</sup>

<sup>1</sup> Faculty of Science, Islamic Azad University, South Tehran Branch, Tehran, Iran  
[Javadi\\_hossein@hotmail.com](mailto:Javadi_hossein@hotmail.com)

<sup>2</sup> Department of Energy Technology, Aalborg University, Aalborg, Denmark  
[faf@et.aau.dk](mailto:faf@et.aau.dk)

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## ABSTRACT

Here arise the problems of modern physics that theories at the quantum scales have been discontinued. Therefore we should pass through the quantum scales and review phenomena at the sub quantum levels. The question is where to enter the sub quantum levels? Answer is; open a new window for massive photons. The reason this answer is that although there are theoretical reasons to accept that the photon is a massless particle. The massless particle is an assumption, also a long series of very different experiments lead to the current experimental upper bound on the photon mass greater than zero. In this article, we analyzed that  $c$  is the edge of visible and invisible particles such as virtual photons and graviton. It leads us passing the real spacetime and enter into the virtual spacetime and describe interactions between real spacetime and virtual spacetime and reach to non-obvious space.

**Keywords:** Spacetime, virtual spacetime, non-obvious

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## INTRODUCTION

There are a lot unanswered questions and complex concepts in theoretical physics that the standard model and relativity do not have answers for and the physicists believe that it is due to the inability of theories (Kane, 2003). Standard model of particle physics describes the fundamental particles fermions and their interactions with one notable exception graviton. Any imagination of space without gravity effect (or no graviton from quantum mechanical perspective), is away from the physical reality. The vacuum of space is not empty. In fact, quantum theory predicts that it teems with virtual particles flitting in and out of existence (Wilson et al., 2011). In QED charged particles can emit and absorb virtual photons. Although these virtual photons can't be observed directly, but the uncertainty principle overcomes this problem. They contribute measurably to the probabilities of observable events. But some calculations can lead to infinities. To avoid mathematical inconsistencies and correct unphysical results, the technique of renormalization is used. The virtual photons can go from one interacting particle to the other faster than light speed (Liberati, Sonogo, & Visser, 2002). The above description shows that there is very narrow

boundary between real and virtual particles in physical phenomena. But this boundary isn't a natural effect our equations had imposed to physical laws. Natural phenomena obey of a unified law. According the special relativity theory, nothing moves faster than light speed. Does it mean there is nothing beyond the light speed in the nature? Our answer is that there are physical beings beyond the speed of light and several papers have been published with different views about faster than light (Hill & Cox, 2012).

In this paper we have reviewed beyond the speed of light by using the quantum mechanics and relativity. It means we believe these theories work well at quantum scales and high speed close to light speed but are not able to work beyond those they have stopped at boundary between the light speed and faster than light. In the classical derivation of Lorentz transformations there is no real solution for speed greater than light so thought has stopped at speed of light. But the physical realities such as vacuum energy and virtual photon showed that the speed of light and visible particles isn't the end of physical spaces. In this paper three physical spaces were considered and analyzed. 1-Real spacetime; everything moves with speed  $v \leq c$  in real spacetime and light speed is

the highest speed in the real spacetime. 2-Virtual spacetime; it calls sub quantum energy (SQE) too and every particle such as virtual particle is explainable in the virtual spacetime. Every virtual particle moves with speed VSQE, so that  $V_{SQE} \geq c$ . 3-Non-obvious space (NOS); everything such as graviton isn't directly (also indirectly) detectable in non-obvious space. Production of non-obvious space is sub quantum energies such as virtual photon, in fact gravitons convert to sub quantum energies and virtual photon is made up of sub quantum energies that explained its mechanism in this paper. Everything moves with speed  $V_G$  so that  $V_G \geq V_{SQE}$  in non-obvious space. Non-obvious space exists without passing time. It is notable that these spaces are indivisible of each other, they are closely intertwined. Any small shear of the available space is composed of above three spaces. Interaction between these spaces causes creation and annihilation the detectable particles.

### MOMENTUM AND ENERGY OF PHOTON IN MODERN PHYSICS

We have almost the same understanding and imagination of large objects (at the level of molecules and larger). But in the case of subatomic particles, there is no clearly defined and visualized concept and there are many uncertainties, especially in the case of photon and graviton. However in this paper we are using the particles without any imagination of them. Photon has a long history in modern physics (Okun, 2008). We will focus on energy and momentum of photon. After 1906 Einstein have derived the second postulate of special relativity the constancy of the speed of light by assuming that the light quanta that he proposed in 1905 were massless particles (Field, 2014). Relativistic energy  $E$  and momentum  $P$  given by,

$$E = \gamma mc^2, \quad p = \gamma mv, \quad \gamma = 1/\sqrt{1 - \beta^2} \quad (1)$$

Where  $\beta = v/c$  and it is just possible that we could allow  $m = 0$  provided the particle always travels at the speed of light  $c$  (Griffiths, 2008). In this case Eq(1) will not serve to define  $E$  and  $P$  so that for massless particle given by,

$$E = |P|c \quad (2)$$

If Eq(1) do not define  $P$  an  $E$ , what does determine the momentum and energy of a massless particle? Not the mass (that's zero by assumption) not the speed (that's always  $c$ ). Relativity offers no answer to this question, but curiously enough quantum mechanics does, in the form of Plank's formula (Griffiths, 2008).

$$E = h\nu \quad (3)$$

Nevertheless, massless photon has a momentum

$$p = \frac{E}{c} = \frac{h\nu}{c} \quad (4)$$

As it follows from the Einstein relativistic mass formula

$$E^2 = c^2 p^2 + m^2 c^4 \quad (5)$$

Only moving photon has mass as follows from the Einstein formula  $E = mc^2$  (Pardy, 2003). Physicists have not stopped on assumption of massless. There are more attempts were made to clarify the photon massless in theoretical and experimental physics. There are good theoretical reasons to believe that the photon mass should be exactly zero, there is no experimental proof of this belief (Hojman & Koch, 2013). These efforts show there is an upper bound on the photon mass, although the amount is very small, but not zero. The tight experimental upper bound of the photon mass restricts the kinematically allowed final states of photon decay to the lightest neutrino and/or particles beyond the Standard Model (Heeck, 2013). Theories and experiments have not limited to photons and graviton will also be included. For gravity there have been vigorous debates about even the concept of graviton rest mass (Goldhaber & Nieto, 2010). Let's close this window and open new window on concept of particles mass. There are two kinds of particles in physics. 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 as Never at Rest condition particles (NR-particles). 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 definitions photon and graviton are NR-particles, while electron and proton are particles.

### A LOOK AT THE INTERPLAY PLACE OF THREE SPACES

Our physical observations and experiences are limiting by the visible universe or real spacetime. We and our tools belong to the real spacetime, and obey of its laws. So we are not able to observe or detect virtual beings. World line of real photon and virtual photon in Minkowski spacetime is the edge of real spacetime where real photon is moving in vacuum with speed  $c$ . The electromagnetic radiation is blueshifted when it is falling in the gravitational field (Photons, 1960). If we want explain blueshift by using quantum mechanics concepts, we should use graviton concept. In interaction between gravity and photon (blueshift) gravitons enter into the photon structure intensity of electric and magnetic fields of photon increase. So gravitons must behave so that they are carrying the charge and magnetic effects in the structure of photon. Photon has no electric effect. There should be two groups of gravitons to neutralize electric effect of each other. 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 increase. In fact color charge and magnetic color do form the negative and positive sub quantum energies (SQEs) and SQEs form the negative and positive virtual photons. Also a real photon is made up of the negative and positive virtual photons. It describes a background of production virtual and real photon in a flat spacetime. Also it can be use to describe the mechanism of vacuum zero point energy (Hossein Javadi & Forouzabakhsh, 2007).

This mechanism happens in the ledge of Minkowski spacetime the mechanism using a natural cutoff of real spacetime in structure of photon of the vacuum region considered. In this natural cutoff all three real spacetime virtual spacetime and non-obvious space involved.

### INTERACTION BETWEEN VIRTUAL SPACETIME AND NON-OBVIOUS SPACE

In standard model graviton is a massless with spin two. But same as photon, there are several experimental searches for massive gravitons that result an upper limits on the graviton mass (Capozziello, De Laurentis, Paoletta, & Ricciardi, 2013). In this paper graviton is a NR-particle and defines as follow.

**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 that  $m_G$  given by

$$m_G < m = \frac{h\nu}{c^2} \quad \forall \nu \quad (6)$$

The relationship between energy and momentum of graviton in all inertial reference frame and any condition by

$$E_G = P_G V_G = \text{constant} \quad (7)$$

Here Eq (7) shows that the energy of graviton is constant in any interaction between gravitons or with other particles.

**Graviton principle:** Any interaction between graviton and other existing particles represents a momentum of inertia  $I$  where the magnitude of  $V_G$  remains constant and never changes. Therefore in all inertial reference frame and any space.

$$\nabla V_G = 0 \quad (8)$$

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. In the case of graviton, we use a Hamiltonian-like to describe the summation of energy generated by transmission energy  $T$  and non-transmission energy  $S$  as,

$$E_G = T_G + S_G = \text{constant} \quad (9)$$

The space is full of graviton. In during the density of gravitons increase in space the distance between them decreases but they do not attach to each other, their paths change without decreasing the magnitude of  $V_G$ . In interaction between gravity and photon in blueshift energy of photon increases and in redshift decreases (De Aquino, 2012). Therefore

$$\text{Gravitons} \Leftrightarrow \text{SQEs} \Leftrightarrow \text{Negative \& Positive Virtual Photon} \quad (10)$$

$$\text{Negative \& Positive Virtual Photons} \Leftrightarrow \text{Real Photon} \quad (11)$$

$$\text{Electromagnetic Energy} \Leftrightarrow \text{Matter + Antimatter} \quad (12)$$

For identifying and understanding the mechanism of physical relationship between the two sides of expressions (10), (11) and converting gravitons into SQEs and vice versa, we must use the equations of Maxwell's electromagnetic theory to explain gravitons. For understanding the mechanism of expressions (11) and (12) using pair production and decay mechanisms we investigated the production of virtual photons. When a photon in a gravitational field as  $\Delta r$  falls, graviton's density in the vicinity of the photon electric field changes the value of  $\partial G_E$  because the intensity of electric field changes as  $E_G$  ( $E$  is the electric field arising from gravitons). Gravitons enter into the structure of photon and the intensity of electrical and magnetic fields which depends on photon increases. Two types of gravitons should enter into 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 into 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 explainable by

$$\nabla \times E_G = -\frac{\partial G_E}{\partial t} \quad (13)$$

By changing the photon's electric field magnetic field also changes. In this case also the gravitons are converted into magnetic carrier NR-particles  $G^m$  and enter into the structure of photon that is given by

$$\nabla \times B_G = \mu_0 \epsilon_0 \frac{\partial E_G}{\partial t} \quad (14)$$

Gravitons in interaction with each other convert to color charges and magnetic color and the electromagnetic fields of photon act as a catalyst only. Therefore we can define a set on non-obvious space (NOS) that is given by

$$\text{NOS set} = \{nG^+, nG^-, kG^m | n, k \in N\} \quad (15)$$

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) that is given by (Francis F & Chen, 1984)

$$r_g = \frac{mv_{\perp}}{|q|B} \quad (16)$$

Where  $r_g$  is the gyroradius,  $m$  is the mass of the charged particle,  $v_{\perp}$  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; A large number of negative color charges and magnetic color do form sub quantum energy SQE. Magnetic color maintains color charges in a tube-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  $\triangleleft$ , so that,

$$\text{Negative SQE} ; \triangleleft = (\kappa G^-, -G^m) \quad (17)$$

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

$$\text{Positive SQE} ; \triangleright = (\kappa G^+, +G^m) \quad (18)$$

Where  $\kappa$  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 SQEs. Therefore generally negative and positive virtual photons are given by,

$$\text{Positive virtual photon} \quad a \triangleright = \gamma^+ \quad (19)$$

$$\text{Negative virtual photon} \quad a \triangleleft = \gamma^- \quad (20)$$

A real photon is given by

$$\gamma^+ + \gamma^- = \gamma \quad (21)$$

$$(n \triangleright + n \triangleleft) = n(\triangleright + \triangleleft) \text{ or } n|\triangleright\rangle + n|\triangleleft\rangle = n|E\rangle \quad (22)$$

Where  $a$  and  $n$  are natural numbers. Also around of  $n \triangleleft$ ,  $n \triangleright$ , the  $G^m$ s move in two different directions, magnetic field is a flow of  $G^m$ s without any starting point. Equations (19) and (20) indicate the process of converting gravitational energy to virtual electromagnetic energy (virtual photon). Also Eqs (21) and (22) show process of converting virtual photon into real photon. The inverse of this process is gravitational redshift that SQEs leave the photon structure and convert to gravitons (Hossen Javadi, 2014). 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 Eq (22) moves with linear speed  $c$  in the same direction as the photon and has non linear speed that is given by

$$|v_G|, |v_{G^-}|, |v_{G^+}|, |v_{G^m}| > |v_{SQE}| > |c| \quad (23)$$

## ON THE CONSTANCY OF THE LIGHT SPEED

Einstein has provided special relativity framework in which Maxwell's equations worked in all inertial frames and Newton's laws also almost worked for any objects moving slowly with respect to a frame. From this new framework all sorts of other effects could be derived and they were all confirmed. The framework ran into trouble with gravity and had to be replaced by General Relativity. We can stop within relativity. We can also think beyond that. In this paper we have chosen the latter. According the pair production and decay we have generalized speed of light from NR-particle into the structure of particle. This is providing a framework in which all particles/objects obey of same law in motion.

## SUB QUANTUM ENERGY (SQE)

**Definition:** Sub quantum energy (SQE) is the least electromagnetic energy that is defined as below,

$$SQE = h\nu_{least} \quad (\nu_{least} < \nu), \forall (E = h\nu) \quad (24)$$

where  $E = h\nu$  is detectable. Equation (24) shows SQE in terms of energy.

**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 SQEs with other particles or fields the speed value of SQE remains constant as in every physical condition have,

$$\nabla v_{SQE} = 0 \quad (\text{In all inertial reference frame}) \quad (25)$$

SQE principle shows the speed value of SQE remains constant and only the linear speed of SQE converts to nonlinear speed and vice versa. The summation transmission energy  $T$  and non-transmission energy  $S$  of SQE is constant that is as

$$E_{SQE} = T_{SQE} + S_{SQE} = \text{constant} \quad (26)$$

The relationship between energy and momentum of SQE (In all inertial reference frame and any condition) given by,

$$E_{SQE} = P_{SQE} v_{SQE} = \text{constant} \quad (27)$$

Every photon (real and virtual) consists of some SQE. Thus according Eq(24) we have,

$$E = nSQE \quad (28)$$

$$E = nSQE = nm_{SQE}c^2 = n(m_{SQE}c)c = np_{SQE}c \\ \Rightarrow E = np_{SQE}c \quad (29)$$

Here  $n$  is a natural number. Compare with Eq(3). For two photons, with energies  $E_1$  and  $E_2$  we have,

$$E_2 = h\nu_2 = n_2SQE, E_1 = h\nu_1 = n_1SQE, E_2 > E_1 \Leftrightarrow n_2 > n_1, n \propto \nu \quad (30)$$

There  $n_1$  and  $n_2$  are natural numbers. 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 Eq(29) and (30) we can relate the relation between photon's energy and frequency and the interaction between SQEs in a photon's structure, i.e. with increasing the number of SQEs in photon, the interactions between SQEs in photon will increase and the frequency that originates from the interactions between SQEs will increase too (H Javadi, Forouzbakhsh, Jahanshir, & Imani, 2012).

**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 interactions of SQEs in photon's structure. Besides the relation between SQEs and  $\nu$  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 the 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.  $|V_{SQE}| > |c|$ . It is considerable 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 (C. E. Dull, 1964). we could take it as a proof of  $|V_{SQE}| > |c|$ .

### LIGHT SPEED PRINCIPLE

Beside the wave-particle duality of light, light is carrying electromagnetic energy, has NR mass that moves at speed  $v$ , also  $v = c$  in vacuum relative to inertial reference frame. In every interaction between light with other particles or fields the speed value of light remains constant; as in every physical condition, in all inertial reference frame and in vacuum  $v=c$  we have,

$$\nabla v = 0 \quad (31)$$

Assume a beam of light enters the Earth's atmosphere from the vacuum, passes the air and enters the ocean, it will be reflected back through the air into the vacuum again. The air or water may be stormy, but when light enters the vacuum, it moves with the same constant speed  $c$  again. Because according to the definition and light speed principle shown in Eq(31) in every condition the speed value of light remains constant and only the linear speed of light converts to nonlinear speed and vice versa. In fact light speed refers to SQEs that light is made up of, for a good sample see the Fresnel drag (Fizeau, 1860). Photon is a part of matter and has NR mass  $m = E/c^2$  and a linear momentum  $\mathbf{p} = mc$  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. So the summation transmission energy  $T$  and non-transmission energy  $S$  of photon is constant that depends to number of SQE in structure of photon that is given by,

$$E_{photon} = E_{nSQE} = T_{nSQE} + S_{nSQE} = constant \quad (32)$$

### MINKOWSKI FORMULA AND SQE

Our physical observations and experiences are limiting of the visible universe or spacetime laws. Because human being and their tools are formed up of spacetime being and obey of spacetime laws. In this paper, we focus on speed and momentum of real and virtual photons, so we use light-like interval that given by;  $c^2t^2 = r^2$  or  $S^2 = 0$ . World lines of NR-particles relative an inertial observer in  $(x, y, z, t)$  frame (by argue not directly) in Minkowski spacetime (Bros, Moschella, Damour, & Darrigol, 2005) can be written as,

$$\text{Real spacetime:} \quad x^2 + y^2 + z^2 = c^2t^2 \quad (33)$$

$$\text{Virtual spacetime:} \quad x^2 + y^2 + z^2 = V_{SQE}^2t^2 \quad (34)$$

$$\text{Non-obvious space:} \quad x^2 + y^2 + z^2 = V_G^2t^2 \quad (35)$$

Eq(33) shows photon worldline is border of real spacetime, worldline of other particles such as electron that moves with speed  $v < c$ , is given by Particles worldline,

$$x^2 + y^2 + z^2 = v^2t^2, \quad v < c \quad (36)$$

World line of other physical being such as virtual photon and graviton is outside of the real spacetime. In Eq(34) when  $V_{SQE} = c$ , virtual particles appear in real spacetime, it is detectable indirectly (in photon structure). When  $V_{SQE} < c$  it is a part of quantum particles such as electron. Boundary between real spacetime and virtual spacetime is speed of light  $c$ . In gravitational blueshift and zero point energy; virtual photons leave virtual spacetime and enter into the real spacetime. Also in gravitational blueshift gravitons of the first leave non-obvious space and enter into virtual spacetime, then leave virtual spacetime and in the second case leave virtual spacetime and enter into real spacetime and they are a part of real spacetime being such as photon and electron. According  $|V_G| > |V_{SQE}| > |c|$ , every visible (detectable) physical being decay, also every virtual particles decay too. But graviton does not decay, in the other word; time does not pass of graviton; the reason is that graviton does not decay to other physical being. If graviton does not experience "time passing", so what means  $t$  parameter in the Equ (36)? This equation is an assumption, for an inertial observer in real spacetime. The above Eq are not the only option, the imaginary of Minkowski's formula is discussed (Chappell, Iqbal, Iannella, & Abbott, 2012). If a graviton writes its world line equation, it maybe same as,  $x^2 + y^2 + z^2 = 0$ . With solution of this equation in imaginary space we have,

$$x^2 = (-1)(y^2 + z^2) = i^2(y^2 + z^2) \quad , \quad x = \pm i\sqrt{y^2 + z^2}$$

Graviton's life is independent of time. It exists and moves in an imaginary space that for human being is not conceivable. Graviton carries information and moves so much faster than light speed. According to color charges and magnetic color  $G, G^-, G^+, G^m$ , in fact graviton is pure information that for a real observer it moves with infinite speed, remember quantum entanglement (Horodecki, Horodecki, Horodecki, & Horodecki, 2009).

### SOLUTION DIRAC'S EQUATION IN THE VIRTUAL SPACETIME

Let's open new windows on Dirac's equation. Equation (5) is relation energy-mass and momentum in special relativity in the special case of a particle at rest (i.e.  $p = 0$ ) is reduced to  $E^2 = m^2 c^4$  therefore the correct equation to use to relate energy and mass in the Hamiltonian of the Dirac equation (Arminjon, 2006) given by,

$$E = \pm mc^2 \rightarrow E_+ = +mc^2, E_- = -mc^2 \quad (37)$$

Here the negative solution was used to predict the existence of antimatter. In pair production, in fact mass-energy (photon) is transferring from spacetime boundary to the inside of spacetime (electron-positron) therefore,

$$\gamma \rightarrow e^- + e^+; S^2 = c^2 t^2 \rightarrow S^2 = v^2 t^t, v < c \quad (38)$$

According to the Eq(29) we have,

$$\begin{aligned} \gamma &= nSQE = 2kSQE \rightarrow e^- + e^+, n = 2k \\ kSQE &\rightarrow e^-, kSQE \rightarrow e^+ \end{aligned} \quad (39)$$

In Eq(39), there are two  $ks$  numerically equal but the pair production process shows there two  $kSQE$  which are not physically identical because a  $kSQE$  converts to  $e^-$  and another to  $e^+$ . Maybe we simply pass this issue but with careful study of the properties of SQEs in the photon structure we can get some interesting results. By choosing  $k_+, k_-$  for the SQEs constituent,  $e^+, e^-$  Eq(38) is,

$$k_-SQE \rightarrow e^-, k_+SQE \rightarrow e^+ \quad (40)$$

According Eq(17) and (18) we have,

$$k_-SQE = k \triangleleft = e^-, k_+SQE = k \triangleright = e^+ \quad (41)$$

In pair annihilation,  $e^+$  and  $e^-$  combine with each other and annihilate. Therefore,

$$e^+ + e^- = k \triangleright + k \triangleleft \rightarrow 2\left(\frac{k}{2} \triangleright + \frac{k}{2} \triangleleft\right) = 2\gamma \quad (42)$$

In pair annihilation, particles (electron and positron) transfer from inside of spacetime to boundary of spacetime (NR-particle) is,

$$e^- + e^+ \rightarrow 2\gamma; S^2 = v^2 t^t, v < c \rightarrow S^2 = c^2 t^2 \quad (43)$$

A photon has no charge and it carries electric and magnetic fields. These properties will be acceptable only when two opposite charged sub energies form a photon.

### NEWTON'S SECOND LAW AND SUB QUANTUM ENERGY

Newton's Second Law has been modified by Einstein's special relativity which is given by,

$$F = \frac{dp}{dt} = \frac{d(mv)}{dt} = v \frac{dm}{dt} + m \frac{dv}{dt} \quad (44)$$

The first experiment that confirmed relativistic mass was the discover by Bücherer of the relationship of the charge of the electron and its mass ( $e/m$ ) was less for fast electrons than for the slow ones (Wilson et al., 2011). According to the definition of the photon and SQE, Newton's second law could be reconsidered. Consider to detectable energy moves with speed  $c$ , by assuming an electron at moment  $t_1$ , with the mass  $m$  and the speed  $v_1$  along an axis in the field (on an inertial frame in the gravitational or electrical field), under the force  $F$  and at the moment  $t_2$ , so its speed becomes  $v$ . Electron takes energy  $dE$  in the interval  $dt = t_2 - t_1$ . According to Eq(29) and at  $t_1$  is,

$$p = mv_1$$

Within the time  $dt = t_2 - t_1$ , the electron gains energy as  $dE$ . At this time the momentum electron changes to

$$dE = np_{SQE}c = nm_{SQE}c^2$$

At the moment  $t_2$  one could write,

$$\begin{aligned} mv_1 + nm_{SQE}c &= (m + nm_{SQE})v \\ v &= \frac{mv_1 + nm_{SQE}c}{m + nm_{SQE}}, v_1 < c \Rightarrow v < c \end{aligned} \quad (45)$$

As  $v_1 < c$ , so always  $v < c$ . Here one could correlate increased mass to the gain of energy in Newton's second law i.e, so,

$$\frac{dm}{dt} = nm_{SQE} = \frac{dE}{c^2}$$

and Newton's second law could be rewritten as,

$$F = v \frac{dE}{c^2} + m \frac{dv}{dt} \quad (46)$$

When a particle loses energy such as inverse of Compton scattering,  $dE < 0$ , particle reduces a part of its mass (Moskalenko, Porter, & Digel, 2006), if a particle takes energy such as Compton scattering  $dE > 0$  its mass increases (Christillin, 1986). The relativistic mass uses in high energies just for showing the speed limit in quantum equations while for well-known subatomic particles always  $v < c$ , in this order only the given energy by particles must be considered and there no need to use the relativistic mass relation. We can better understand and explain the physical phenomena by using Newton's second law as an Eq(46). Through such a view of physical and astrophysical phenomena the explanation of the universe would be more real. According to the Sub Quantum Energy Principle the speed value of all subatomic particles would be always constant and external force could only convert the SQE's linear motions to nonlinear motions and vice versa. The speed of the created particles is a function of the internal interactions and the mechanism of creation of subatomic particles and the

external forces that are exerted on them. For example look at pair production and decay. Thus light speed is constant in vacuum but it changes in medium and as soon as it enters vacuum it travels at former constant speed  $c$  see light speed principle.

## CONCLUSION

Classical mechanics and both special and general relativity describe 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 sub quantum layer done. 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. In addition we showed that how we can use the non-obvious space to describe nature of time in order to understand better the nature of real and virtual spacetimes. All our theories today seem to imply that the universe should contain a tremendous concentration of energy even in the emptiest regions of space. In this paper, according to SQE we analyzed vacuum energy without using uncertainly principle and reconsidered relativistic Newton's second law (Hossein Javadi & Forouzbakhsh, 2014). For long time seemed the Friedmann equations was able to explain universe, but in recent years, the cosmological constant was of interest to cosmologists.

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- However, these two equations are unable to explain before the Big Bang. Also there is very good evidence that in the first fraction of a second of the big bang the universe went through a stage of extremely rapid expansion called inflation. The fields responsible for inflation can't be Standard Model ones. According to SQE we showed there isn't a zero volume with infinite density in singularity also before the Big Bag. By using the SQE, we reviewed Friedmann equation and explained before the Big Bang and the reason of extremely rapid expansion in the first fraction of a second of the Big Bang (Hossein Javadi & Forouzbakhsh, 2014). 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 (Hossein Javadi & Forouzbakhsh, 2013) and (Hossein Javadi & Forouzbakhsh, 2014). So, regardless to reconsidering the relativistic Newton's second law and sub quantum energy concept, how we can resolve the dark energy problem?

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