

# Unified Force, Energy and Mass

Hossen Javadi

*Invited professor of the Faculty of Science at Azad Islamic University, Tehran campuses  
Tehran, Iran*

[Javadi\\_hossein@hotmail.com](mailto:Javadi_hossein@hotmail.com)

## **Abstract:**

For Newton, the force of gravity was merely a function of masses and the distance between them. Maxwell unified electric and magnetic fields into a symmetric coherent set of equations known as Maxwell's equations. For Einstein, gravity was caused by a deformation of space-time continuum. On this basis, he developed a highly complex algebra that merely describes it geometrically. Nowadays the majority of studies explain only the effects of gravity and not its nature. The unification of gravity with electricity has been a challenge for many great physicists of the last century. Einstein dedicated almost 25 years to the problem without success, while, in 1968, Dirac suggested that it would not be possible to unify the fundamental forces [1].

Was Dirac right? There isn't a unified force in nature? We know many physicists had been working hard to find a unified field theory. Also, they predicated many interesting theories. In this field hardest efforts had belonged to String Theory. After long year's research and thought, I have understood any effort for finding a unified theory without considering conversion of the force and energy does not have any considerable success. In fact there is a unified force/particle in nature. In other words, Force and Energy are convertible. Also according to Relativity, mass and energy are equivalent. So, Force, Energy and Mass are three manifests of a unified entity. And it leads us to change our perception about force, energy and mass.

**Keyword:** graviton, photon, color charge, magnetism color, negative and positive virtual photon, unified

# Unified Force, Energy and Mass

## Introduction

Since the 19th century, some physicists have attempted to develop a single theoretical framework that can account for the fundamental forces of nature - a unified field theory.

Classical unified field theories are attempts to create a unified field theory based on classical physics. In particular, unification of gravitation and electromagnetism was actively pursued by several physicists such as Faraday [2] and Einstein [3]. Einstein believed there was a link between the need to resolve apparent paradoxes of quantum mechanics and the need to unify electromagnetism and gravity [4]. Classical unified field theories were unsuccessful, but we can unify quantum field theory with gravity by adjusting some concepts of quantum mechanics.

Today's physics is outspread between macro and micro worlds. General Theory of Relativity describes Macro world very well, while Quantum Mechanics describes probability in micro world very well, too. But problem occurs when we want to unify these two theories into the one that would be able to describe each phenomenon in the universe.

In standard model graviton is a massless with spin two. But same as photon [5], there are several experimental searches for massive gravitons that result an upper limits on the graviton mass [6]. To redefine graviton, let's consider to a photon that is falling in the gravitational field, and revert back to the behavior of a photon in the gravitational field. When a photon is falling in the gravitational field, it goes from a low layer to a higher layer density of gravitons. We should assume that the graviton is not a solid sphere without any considerable effect.

Graviton carries gravity force, so it is absorbable by other gravitons; in general; gravitons absorb each other and combine. When some gravitons are around a photon (or other particles), they convert to color charges and enter the structure of photon. Color charges around particles/objects interact with each other.

There are many layers of gravitons around a photon. The first layer is close to the photon, so that its gravitons interact with charge and magnetic fields in the structure of photon. The second layer interacts with the first layer and third layer and so on. Therefore; when a photon is falling in the gravitational field of the Earth, two layers of gravitons are applied on it, first layer up (at high  $h$ ) and second down (at high  $h-dh$ ). In down layer, the density of graviton is greater than up, so the photon falls and its energy increases [7]. So, we can redefine graviton relative to electromagnetic energy.

Also motion is an intrinsic property of physical existence. But there is a problem about concept of acceleration in theoretical physics.

First of all, what we know about acceleration? And what is the definition of acceleration? In physics, acceleration is the rate at which the velocity of an object changes over time that in classical mechanics is given by Newton's second law with  $a=F/m$ . In special relativity an accelerating particle has a world-line which is not straight. This is not difficult to handle. The 4-vector acceleration can be defined as the derivative with respect to proper time of the 4-velocity. It is possible to solve the equations of motion for a particle in electric and magnetic fields, for example [8]. Accelerating reference frames is a different matter.

In general relativity the physical equations take the same form in any co-ordinate system. In special relativity they do not but it is still possible to use co-ordinate systems corresponding to accelerating or rotating frames of reference just as it is possible to solve ordinary mechanics problems in curvilinear co-ordinate systems. This is done by introducing a metric tensor [8].

However, 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 era. It should be noted that the interaction between large objects (e.g.

# Unified Force, Energy and Mass

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. It means we should review the relativistic Newton's second law [9].

## Rest mass

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.

## Theoretical formalism of reviewing

In reviewing graviton and Newton's second law, I have presented the new definition of graviton as follows [9]:

**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  $\mathbf{I}$  where the magnitude of  $V_G$  remains constant and never changes. Therefore;

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

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:

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

Since the speed and mass of graviton are constant, then  $E_G = \text{constant}$ .

## 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. Suppose a photon falls in a gravitational field, its energy (mass) increases. According to;

# Unified Force, Energy and Mass

$$W = \Delta mc^2 \quad (3)$$

The force of gravity performs work on the photon, so the mass (energy) of the photon increases.

However, the energy of a 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. This question arises that what happens in during the gravitational blueshift?

## Color charges and color magnetism

The change of frequency of a photon in a gravitational field has been demonstrated by the Pound-Rebka experiment [10]. When a photon falls in a gravitational field, it acquires energy equal to  $\Delta mc^2$ ; 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 [11]. In quantum mechanical theory, every field is quantized. In addition, force is described as energy per distance shown by:

$$F = -\frac{dU}{dx} \quad (4)$$

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, some graviton disappear and the energy of the photon increases. Similarly, Red Shift has the opposite effect. As a photon escapes from a gravitational field, its frequency shifts to red and its energy converts to gravitons. How can we describe this interaction between photons and gravitons on a sub-quantum scale such as in the structure of a photon?

## 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 [9].

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

$$SQE = h\nu_{least}, \nu_{least} < \nu, \forall E = h\nu, \text{ where } E = h\nu \text{ is detectable} \quad (5)$$

Relation (5) shows  $SQE$  in terms of energy. Every other photon consists of some  $SQE$ , so that;

$$E = nSQE, \text{ where } n \text{ is an integer} \quad (5)$$

$$E = nSQE = nm_{SQE}c^2 = n(m_{SQE}c)c = np_{SQE}c \Rightarrow E = np_{SQE}c \quad (6)$$

# Unified Force, Energy and Mass

For two photons with energies  $E_1$  and  $E_2$  we have:

$$E_2 = h\nu_2 = n_2SQE, E_1 = h\nu_1 = n_1SQE, E_2 > E_1 \Rightarrow n_2 > n_1, n \propto \nu \quad (7)$$

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 (7) 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 photons, the interaction between *SQEs* in photons will increase and the frequency that originates from the interaction between *SQEs* 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 *SQEs* in a photon. 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 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 5); that we could take it as a proof of  $|V_{SQE}| > |c|$ .

## 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 we have;

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

*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;

# Unified Force, Energy and Mass

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

So the constancy speed of light is a law [9].

## 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 to the pair production and decay, we have generalized speed of light from NR-particle into the structure of particle [9]. This is providing a framework in which all particles/objects obey of same law in motion.

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. Thus, according to the equivalence of mass-energy  $E = mc^2$ , all particles have been made of *SQEs*. Photon moves with constant speed  $c$  in vacuum. But in a non-vacuum environment (such as water) it moves with linear speed  $v = c/n$  ( $n$  is refractive index), it does not mean that light loses its speed, but it means that in a non-vacuum environment, a part of the linear speed of *SQEs* that belong to photon, becomes non-linear speed.

Once photon passes through non-vacuum environment and enters the vacuum, it moves with speed  $c$  again. The photon speed is from *SQE*, and *SQE* speed is fed by gravitons. . So according the definitions of graviton, *SQE* and photon we can show that  $V_G > V_{SQE} > c > v_{particle}$  (for every particle such as electron, proton...).

## Acceleration

The source of all physical energies is electromagnetic energy that refers to *SQE* properties. When you shoot a ball, your foot acts on ball, your foot applies force on ball, while your foot is applying force on the ball, energy of your body converts to electromagnetic energy that is made up of *SQEs*, and *SQEs* are transferring with speed  $c$  from your feet to the ball. When a stone falls in the gravitational field on the earth, gravity works on stone. During the stone is falling, gravitons convert to *SQEs* and enter the stone structure, according to the momentum conservation law, sub atomic particle of stone and *SQEs* share their momentum, then it seems the linear speed of stone increases. But stone is made up of *SQEs*, and total linear and nonlinear speed of *SQE* is constant, so, when stone gets linear acceleration, nonlinear speed of stone's *SQEs*, converts to linear speed and vice versa. We can describe all kinds of energy, also heat, thermodynamics laws and entropy by using the concept and principle of *SQE*. In generally,

# Unified Force, Energy and Mass

acceleration is an outward phenomenon, and nonlinear speed of SQEs converts to linear speed and vice versa.

## Electromagnetic fields convert to electromagnetic energy

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 [12].

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.

According to the experimental observations, I generalized 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  $\gamma^+$  and positive charged particle produces negative virtual photon  $\gamma^-$ . 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 [11], that given by;

$$\gamma^+ + \gamma^- = \gamma \quad (8)$$

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 [11]. So, electromagnetic force converts to electromagnetic energy and vice versa.

## Ballistic

I take a shot on my hand and bring it upward the earth with constant velocity. Its situation changes relative the earth. When shot is moving with constant velocity by my hand, two forces applied on it. One of them is upward by hand and other one is toward the earth by gravity force (gravitons).

My hand gives energy into shot and putting it upward the earth. And gravitons leave shot and pushing it toward earth (on my hand). So its mass is stable. Also gravitons (of gravity field) enter into shot, but shot exchanges them like above explaining (earth gravity and shot are balanced). When shot reaches to high h, I drop it. Gravitons pushing shot toward earth and it falls. In during shot is falling, gravitons convert to kinetic energy. When shot reaches to the surface of earth, kinetic energy converts to electromagnetic energy such as heat.

## Shooting shot

I take a shot with mass m and shooting it with velocity v upward. Shot takes kinetic energy. The action of my hand on shot is applying force on it, only. In the other word, in during dt, n photons (as energy) leave my hand, convert to force and applies on shot, its momentum changes

# Unified Force, Energy and Mass

(Newton's second law). The photons enter into structure of shot and convert to energy again. So, shot takes kinetic energy equal  $\frac{1}{2}mv^2$  to upward.

## Generator

I do rotating the dynamo of a generator and produce electromagnetic energy. I apply force on dynamo and it rotates. The magnetic field of dynamo's magnet does change. The electric charge of electrons in wires, those are around the dynamo doing opposite with changing the magnetic field. Then electromagnetic energy produces. How and why rotating dynamo produces electromagnetic energy?

My hand's force does rotating the dynamo, only. In the other world, in during rotating dynamo my body's energy changes to force, and force changes to mechanical energy. When the magnetic field changes, then electric field does change. Changing electric field does change the electron motion. But we know force is able to changing the motion of everything. So, electron takes gravitons (color-charges and magnetic color) and condenses them, and produces a quantum electromagnetic energy.

## Spring

Take a look at spring. There is a spring with one of its sides connected to the wall (Figure 1). In formal physics it is defined by the conversion of potential energy and kinetic energy. Let us explain it according to the conversion of force and energy.

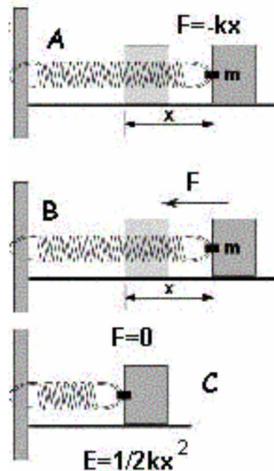


Fig1, force converts to energy and vice versa

A. The spring is pushed by hand. During the time that hands were pushing the spring, hand's energy converts to force. In fact a lot of photons leave the hand and enter the spring. Hand loses momentum and energy. Spring (and object) takes momentum and energy. The force of spring given by relation  $F = -kx$ , that applied toward the left side. In during we are pushing spring, n photons enter to object and from object enter to spring. The momentum (and energy) of these photons are transferred to the object and spring. These photons convert to force, when they enter to spring, and that cause sprig applies force.

# Unified Force, Energy and Mass

In during we are acting on object (and spring), n photons leave hand and enter to object. And k photons leave object and enter to spring ( $k < n$ ). When we drop object, it does stop and spring pushes object toward the left side.

**B.** Force is converting to energy. Spring will return to its equilibrium situation. Object opposes with the spring's movement. The force of the spring converts to energy and the amount of force decreases and energy increases.

**C.** No force is applied on object, but energy is maximum; the object is moving toward the left side and its energy converts to force (in spring).

## Light in gravitational field

If movements in the space are without any gravitational effects, photons move linearly with the speed of  $c$  (top of Figure 2). But space is full of gravitons. So, photons' paths are like the right side of Figure 2.

Left side of Figure 2 shows that a photon is moving in a gravitational field of a massive body.

In point A, the photon has the speed  $c$ , frequency  $\nu$  and energy  $E$  that reaches to point A. Gravitational field acts on the photon, some gravitons enter the structure of the photon. Photon accelerates toward the massive body. Its frequency, energy and speed increase.

In point B, the photon has a frequency  $\nu_1$ , energy  $E_1$  and speed of  $c_1$ . During the time that photon is falling, the distance between the photon and body decreases, until it reaches the point G. In point G Frequency, speed and energy are maximum for this photon. When photon reaches point F', it is the same as point F, and so on. In point A' A', it is the same as point A.

The behavior of photons and gravitational fields is the same as spring and objects. On the left side of Figure 2, when a photon is falling, it shifts to blue and the gravity force converts into energy. When photon is escaping from a massive body it shifts to red and energy converts to gravity force (Figure 2).

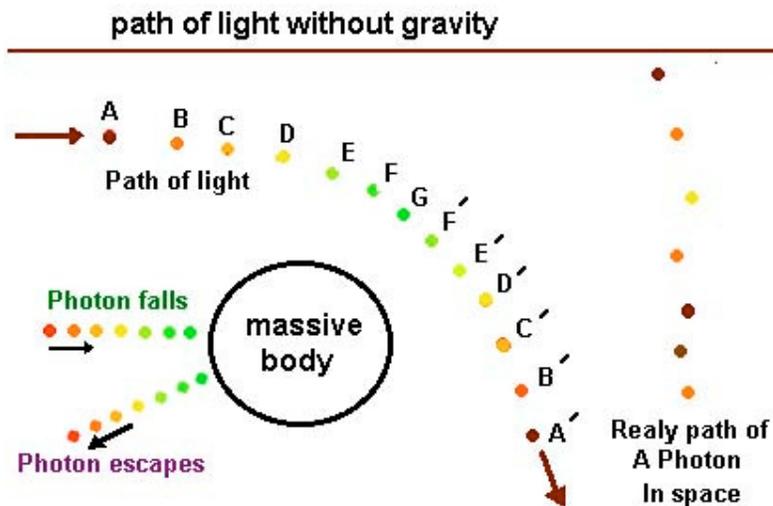


Fig2; path of photon in space

# Unified Force, Energy and Mass

When gravity force acts on photon, the energy of the photon increases and its frequency increases too (or decreases). In red-shift work is negative (frequency decreases) and in blue-shift work is positive (frequency increases). When photon is leaving gravitational field, it shifts to red and when photon is falling it shifts to blue. When light is moving in space that there is no gravitational effect, the path of light is linear. Now suppose light is moving in gravitational field of a massive body. Gravity works on it.

When distance between photon and massive body goes to short, light shifts to blue like photon is falling. But when distance between photon and massive body goes to long, light shifts to red like photon escapes (Figure 3). What the inside observer observes is the opposite of what the outside observer observes.

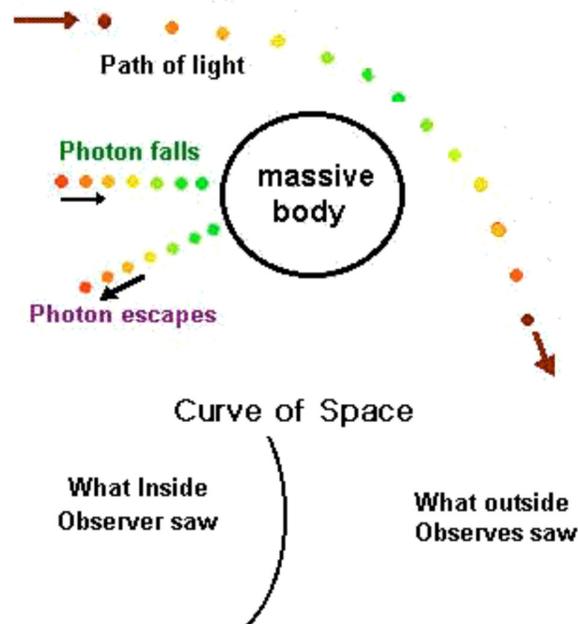


Fig 3; gravitons bend the space

## Conclusion

In Einstein's day, the strong and weak forces had not yet been discovered, but he found the existence of even two distinct forces, gravity and electromagnetism, deeply troubling.

Einstein did not accept that nature is founded on such an extravagant design. This launched his 30-year voyage in search of the so-called unified field theory that he hoped would show that these two forces are really manifestations of one grand underlying principle.

The sub quantum approach propounded that force and energy are convertible to each other, so the sub quantum approach may provide the answer. From one principle - that graviton moves with constant amount of speed  $V_G$  and  $\nabla V_G = 0$  in all inertial frames and in any space - the sub quantum approach provides a single explanatory framework capable of encompassing all forces and all matter and anti-matter.

The sub quantum approach proclaims for instance that the observed particle properties - that is, the different masses and other properties of both the fundamental particles. And the

# Unified Force, Energy and Mass

force particles (bosons) associated with the four forces of nature (the strong and weak nuclear forces, electromagnetism, and gravity) -- are a reflection of the various ways in which graviton can move in structure of matter or photon. Just as the photons or gravitons in empty space, patterns that light or gravity effect reach to earth of a very far star.

The sub quantum approach - the ultimate explanation of the universe at its most microscopic level, a theory that does not rely on any deeper explanation - we would provide the firmest foundation on which to build our understanding of the world. The sub quantum approach would mark a beginning, not an end.

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