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Adaptive Review of Three Fundamental Questions in Physics

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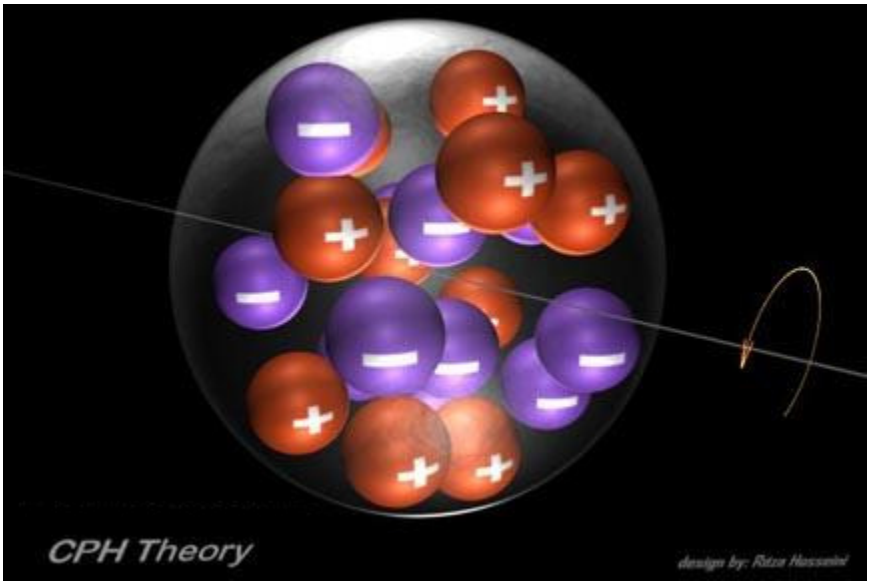

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Adaptive Review of Three Fundamental Questions in Physics

Abstract:

In the recent decades, the amazing changes have occurred in the theoretical physics and the rate of its improvement has been rising very extensively. The neutron and positron were discovered in 1932 which before that only electron, proton and photon were known. Today, the Standard Model of elementary particles is the leading dominant theory. The fundamental particle is a particle whose substructure is still unknown, thus it is unknown whether it is composed of the other particles[1] or not. Although the Standard Model describes the phenomena within its domain accurately, it is still incomplete. Perhaps it is only a part of a bigger picture of the modern physics which includes the deeper and hidden layer of subatomic world that has been dipped into the darkness of the universe[2].

The question is, where is the hidden part of modern physics? Hidden part of modern physics lies beyond the uncertainty principle. Included in the sub quantum scale, where quantum interactions between photons and gravitons done. Hidden and dark side of modern physics is also a place where charged particles absorb and emit energy quanta, without any description of the mechanism of absorption and emission by charged particles. In modern physics, a charged particle creates an electric field itself, but the mechanism of this process is ambiguous and does not explain how a charged particle creates an electric field?

And above all, what is the scientific and precise definition of a fundamental particle? If we want to reach the different results, we need to change our thoughts and scientific beliefs. In this paper, by a new viewpoint to the basic laws of physics, three fundamental questions in physics has been discussed and analyzed in hidden parts of the standard model and physical theories.

[1] - Elementary particles, WorldNews, http://news1.linktv.org/topics/elementary-particle

[2] - The Standard Model, CERN Document Server, http://home.cern/about/physics/standard-model

Adaptive Review of Three Fundamental Questions in Physics

Contents:

1

Physical theories activities

We don't know how primitives started thinking about physical behaviors of nature with what questions, but according to physical theories that roughly is available in all human communities(such as China, India, Iran, Mesopotamia, Egypt, ancient Greece, etc.), it can be generalized to the following three principal and essential questions:

1- What is nature made of, or in other words, what are the main substances and elements that form the nature? In nowadays physics, what are the fundamental particles of the nature?

2- How nature works, or how is the method of interaction between fundamental particles of the nature and their productions?

3- What is time, or in fact, what is the physical nature of time?

These three questions are not separable from each other, because the reason that what the nature has made of relates producing elements of the nature with process of working and production that is also in relation with how the functionality of nature is[1]. The way that how nature works is not imaginable without "time passing", because functionality of nature is a kind of changing and changing is in relation with time.

Due to this reason, each physical theory includes its essential quantities and describes the way of interaction between them, so the quantity of time could not ignored. Therefore either of three theories (Classic Mechanics, Quantum mechanics, General and Special relativity) have their own

[1] - Marco Mamone Capria, "Physics Before and After Einstein" Publisher IOS Press, 2005, http://www.dmi.unipg.it/~mamone/pubb/PBAE.pdf

Physical theories activities

elements, describe the way of interaction between them and they have a special vision to the quantity of time.

Newton's laws started actual knowledge physics. Newton's findings were a set forth in his book entitled "Mathematical Principles of Natural Philosophy", the publication of which in 1687 marked the beginning of the modern period of mechanics and astronomy. Newton[1] formulated his physical laws while René Descartes[2], Kepler[3] and Galileo[4] prepared necessary elements already. Simplicity and elegance of Newton Laws have summarized in the three following items:

1 - Newton derived out physics knowledge from descriptive and interpretative state for the first time and formulated interaction between objects in mathematical form.

2 - The least numbers of physical quantities such as mass, force, distance, time, velocity, momentum and its changes, formulated these equations.

3 - These equations are universal that show their common perspectives and differences of movement and inertia of objects on the earth with circulation of planets around the stars in differential form.

From the Newton's point of view, the time was an absolute quantity and a global scale that there existed independent of anything and physical phenomenon. In Newtonian laws, absolute Space is the study of space as an absolute, unmoving reference point for what inertial systems (i.e. planets and other objects) exist within it. Absolute time, absolute space and absolute movement were the cases that Newtonian Mechanics had formed based on them. This insight into being absolute in Newton laws caused many ambiguities in Newtonian mechanics. Moreover, mass was invariant in Newton equations in general and independent of its quantitative value. It means that Newton had not been specially considered fundamental particles, but his equations was too fundamental and universal that covered any objects or masses containing particle, even fundamental particles in modern physics.

At the beginning of 19th century, Michael Faraday[5] found that electricity and magnetics have close relation. Faraday introduced the concept of field for the first time and in the time of Maxwell[6], it was widely used in which according to it forces transform through fields; for example, gravitational force is transformed trough gravitational field. In 1864, Maxwell formulated electromagnetic equations and codified how to produce a magnetic field by a variable electric field and vice versa. Maxwell equations in electromagnetics have the same importance in which Newton laws of motion have in classic mechanics. Maxwell equations are fundamental the same as Newton laws and even Maxwell equations are more fundamental. Because Maxwell's equations remain consistent with special relativity, in fact, in special relativity, the electric and magnetic field gets unified to only one electromagnetic field. Maxwell's introduction of the concept of fields to explain

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[1] - Sir Isaac Newton, (1643-1727), an English physicist and mathematician

[2] - René Descartes (1596-1650), a French philosopher, mathematician and scientist.

[3] - Johannes Kepler (1571-1630) a German mathematician, astronomer, and astrologer

[4] - Galileo Galilei (1564-1642) an Italian astronomer, physicist, engineer, philosopher, and mathematician

[5] - Michael Faraday (1791-1867) an English scientist who contributed to the fields of electromagnetism

[6] - James Clerk Maxwell (1831-1879) a Scottish scientist in the field of mathematical physics

physical phenomena provided the essential link between the mechanical world of Newtonian physics and the theory of fields, as elaborated by Einstein and others, which lies at the heart of twentieth and twenty-first century physics[1].

Albert Einstein[2] founded relativity by presenting two theories, special relativity in 1905 and general relativity in 1915. Special relativity by discarding an absolute reference frame (ether) showed that physical laws are the same in all inertial reference frames and speed of light in vacuum has the constant value c, regardless the movement of source and being static or moving observer, and speed of light is the limit of speeds. According to special relativity, speed of light in vacuum is a universal constant for all inertia observers, but other quantities like momentum, length, mass and time change according to observational frame of reference. According to Einstein's famous equation $E = mc^2$ the energy E of a physical system is numerically equal to the product of its mass m and the speed of light c squared. It is customary to refer to this result as "the equivalence of mass and energy," or simply "mass-energy equivalence[3]." Mass-energy equivalence, $E = mc^2$ expresses the association of mass with every form of energy. Neither of two separate conservation laws, that of energy and that of mass (the latter particularly the outcome of countless experiments involving chemical change), is in this view perfectly true, but together they constitute a single conservation law[4].

According to special relativity, velocity causes slowing down the time, It means that the time that is measured by a stationary observer, is longer than the time that is measured by a moving observer in which is got away from him/her. In relativity, synchronization of events depends on reference frame that investigates synchronous observer. It is well known that synchronization within an inertial frame using the methods of light rays or slow separation of clocks results in synchronization that is specific to that inertial frame[5].

General relativity analyzes accelerated systems of reference. In fact, gravitational field is an accelerated system of reference. In general relativity, gravity is not an essential force; even it is geometrical effect of mass on the space. Einstein said that gravity can be looked at as curvature in space-time and not as a force that is acting between bodies[6].

In accelerated systems of reference, the space curves, because the path of light is a curve while passing through a gravitational field that proposed as "space-time" curve. Because space-time is

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[1] - Malcolm Longair, "a commentary on Maxwell (1865) 'A dynamical theory of the electromagnetic field", ROYAL SOCIETY PUBLISHING, 2015, http://rsta.royalsocietypublishing.org/content/373/2039/20140473

[2] - Albert Einstein (1879-1955) a German theoretical physicist

[3] - The Equivalence of Mass and Energy, The Stanford Encyclopedia of Philosophy http://plato.stanford.edu/entries/equivME/

[4] - Principles of physical science, Encyclopaedia Britannica, http://www.britannica.com/science/principles-of-physical-science/Conservation-laws-and-extremal-principles

[5] - zur elektrodynamik bewegter körper, A. Einstein, 1905, http://users.physik.fu-berlin.de/~kleinert/files/1905_17_891-921.pdf

[6] - The Principles of General Relativity, http://www.rafimoor.com/english/GRE1.htm

bent and whatever its curvature becomes more, the clock works slower. It means that in stronger gravitational field, the clock works slower than weak one.

One of the more important differences between relativity and classic mechanics relates to mass. Mass in special relativity incorporates the general understandings from the concept of mass–energy equivalence. The word "mass" is given two meanings in special relativity: one "rest mass" m_0 is an invariant quantity, which is the same for all observers in all inertia reference frames; the other "relativistic mass" m is dependent on the velocity v of the observer that is given by:

$$m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}} \qquad (1)$$

Therefore, the rest mass and moving mass of particle has different values for an observer. It does not imply increasing the number of formed particles of mass, but it shows the masses of all particles have increased. Nevertheless, this increasing of the mass is equal to kinetic energy of that mass in which is explainable by means of relation $E = mc^2$. Due to this from the viewpoint of relativity, a particle with non-zero rest mass is not able to reach speed of light. Therefore, it is an assumption that the rest mass of photon and other particles that are able to move with speed of light is equal to zero. It is notable that the zero rest mass of photon is only an assumption[1] and even Einstein emphasized[2] on it.

Changing the mass due to change in speed is explainable by according to relation $E = mc^2$. Therefore, by reconsidering the relativistic Newton's second law and got wonderful results and by using it, we can solve many unanswered problems in modern physics[3].

By comparing both theories classic mechanics and special relativity, time is dependent of the method of nature performance and limit of speed. In classic mechanics, increasing the speed is unlimited and time is an absolute quantity, while in special relativity, the speed is limited and the time is a relative quantity and is a function of speed. Moreover, it is considerable that changing the speed of a mass (clock) depends on an external force that imposes on it. Due to this reason, the ticking of a clock is a function of gravitational field intensity.

In 1900, Max Planck[4] proposed the quantum concept of radiation and established quantum physics. In 20th century, knowledge of physics had many wonderful advancements and one of the most important achievements in quantum mechanics is to codify the standard model of fundamental particles. In standard model, fundamental particles of the nature include 12 fermions

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[1] - Griffiths, D. (2008). *Introduction to elementary particles*: John Wiley & Sons, page 90

[2] - Field, J. (2014). Einstein and Planck on mass-energy equivalence in 1905-06: a modern perspective. *arXiv preprint arXiv:1407.8507*

[3] - Lisa Winter, Top 10 Unsolved Mysteries of Science, 2014
http://www.iflscience.com/physics/top-10-unsolved-mysteries-science
Lawrence M. Krauss, The Big Unanswered Questions, 2012
http://www.huffingtonpost.com/lawrence-m-krauss/the-big-unanswered-questi_1_b_7151666.html

[4] - Max Karl Ernst Ludwig Planck (1858-1947) a German theoretical physicist

and 4 bosons. Fermions include six quarks (up, down, charm, strange, top and bottom) and six Leptons (electron, electron neutrino, muon, muon neutrino, Tau, Tau neutrino).

In quantum field theory (QFT), interactions between particles are described by interaction terms between the corresponding underlying quantum fields. In contrast to many other physical theories there is no canonical definition of what QFT is[1]. However, all four fundamental interactions can be explained as due to the exchange of virtual particles (exchange particles or gauge bosons), as follow:

Interaction	Exchange particles	Range (m)
strong	gluon (between quarks) mesons (between hadrons)	10^{-15}
electromagnetic	virtual photon	∞
weak	W^-, W^+, Z	10^{-18}
gravitational	graviton	∞

The graviton is a hypothetical elementary particle that mediates the force of gravity in the framework of quantum field theory. Bosons are messenger particles between fermions and sometimes between themselves that form quantum field theory[2].

In quantum electrodynamics (QED), all interactions between charged particles is described with respect to exchange of photons. The photon has to be a virtual photon, because emission of a real photon would violate energy and momentum conservation[3]. It should be noted that there is no consensus about virtual particles, some physicists agreed virtual particle exist[4], and others are believed that they are merely a mathematical bookkeeping device for QED.

In quantum mechanics, quantity of time is proposed in a more fundamental style. For example, in standard model a photon that moves with constant speed of limit c, does not experience "time passing"[5]. Moreover, some theories based on quantum mechanics do not accept the existence of time in quantum scales[6].

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[1] - The Stanford Encyclopedia of Philosophy, "Quantum Field Theory", http://plato.stanford.edu/entries/quantum-field-theory/#Intro

[2] - Astronoo, http://www.astronoo.com/en/articles/subatomic-particles.html

[3] - The Standard Model, http://electron6.phys.utk.edu/phys250/modules/module%206/standard_model.htm

[4] - Gordon Kane, Scientific American, 2006
http://www.scientificamerican.com/article/are-virtual-particles-rea/
Marianne Freiberger and Rachel Thomas, "Quantum pictures", 2013
https://plus.maths.org/content/quantum-pictures

[5] - Physics - Standard Model, http://www.whillyard.com/science-pages/electromagnetic-force.html

[6] - http://www.popsci.com/science/article/2012-09/book-excerpt-there-no-such-thing-time

Physical theories activities

Also in recent years, it has been paid attention a lot to the existence and describing gravitons, because many problems in modern physics is due to lack of recognition about modality of gravity in field quantum theory (QFT). In quantum mechanics, graviton of a particle by spin 2 is massless that moves with the speed of light c, this definition is not consistent with experimental realities. Due to this, in recent papers, even the mass of a graviton[1] is discussed and recently its experimentally process is on the agenda in CERN Lab[2]. Therefore, these issues show that we need to a new definition of graviton and the mass of fundamental particles that will be presented in next chapters.

In relativity, in addition to the changing the path of light rays, the energy of rays changes, too. In addition, photon is a package of energy and this problem that how gravitational field effects on a photon and how it changes electric and electromagnetic fields of photon? It is one of the ambiguities of modern physics that relativistic quantum mechanics does not have any clear explanation about that it is just explainable by a new definition of a graviton.

Although theories of quantum mechanics and general relativity have good functionality in their own ranges, but they are inconsistent with each other intensively. Therefore, it seems that mass and energy are equivalent, but they are not the same and this difference must be reflected in new theory. It means by accepting this fact that mass is an invariable quantity, (as in classical mechanics was accepted), it must be presented a new definition of acceleration, field and structure of fundamental particles that can explain and justify behavior of photon in a gravitational field and relation between changing of energy and frequency of photon in a gravitational field.

In quantum electrodynamics (QED), a charged particle consequently propagates exchange particles containing electromagnetic force. This process does not have any effect on properties of a charged particle like mass and electric charge. How can be justified this phenomena?

If a charged particle as a producer (generator) has an output that is known as a virtual photon, then what is its input?

According to quantum mechanics, an oscillator possesses a definite zero-point energy of vibration, and an attempt has been made to express this result directly in terms of some general principle. It has been found that the result may be deduced from the uncertainty principle, in view of the particular relation between position, momentum and energy in a simple harmonic field[3]. In addition, The Zero Point Energy (ZPE) is an intrinsic and unavoidable part of quantum physics. The ZPE has been studied, both theoretically and experimentally, since the discovery of quantum

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[1] - L. S. Finn and P. J. Sutton, “Bounding the mass of the graviton using binary pulsar observations,” Physical Review D, vol. 65, no. 4, Article ID 044022, 2002 , There is a link between the cosmological constant and the graviton mass. http://www.hindawi.com/journals/isrn/2014/718251/

[2] - Graviton production through photon-quark scattering at the LHC, Phys. Rev. D 91, 035017 – 2015 http://journals.aps.org/prd/abstract/10.1103/PhysRevD.91.035017

[3] - R. A. NEWING, "Uncertainty Principle and the Zero-Point Energy of the Harmonic Oscillator", Nature 136, 395-395 (07 September 1935) | doi:10.1038/136395b0

mechanics in the 1920s and there can be no doubt that the ZPE is a real physical effect[1]. In cosmology, the vacuum energy is one possible explanation for the cosmological constant[2]. If there is zero point energy (ZPE) in space (vacuum), how can we describe it without using uncertainty principle?

In quantum mechanics, concept of particle by using Heisenberg's uncertainty[3] principle is very complicated, because, even a fundamental particle without internal structure occupies a non-zero volume. However, there is a difference between fundamental particles like electron, photon or quark that do not have internal structure with compound particles like proton that have internal structure. So based on quantum mechanics that photon is a particle without structure, how can we explain the relation between energy and frequency of a photon or pair production and decay (electron-positron)?

In quantum electrodynamics (QED), charged particles (like electron and positron) interact with each other through propagation and absorption of photons. These photons are virtually and they are not visible or detectable. However, their existence violates the law of conservation of energy. But the uncertainty principle prevents a contradiction[4]. Is there any way for explanation of virtual photons (in fact interaction between charged particles) without using uncertainty participle?

So this question arises: what is the properties of a particle that could be really a fundamental particle? In CPH theory, a fundamental particle is a particle that is not decayed under any condition or is not convertible into other particles. Such a particle must be constant mass (energy), therefore, the value of speed must not change.

By this definition of fundamental particles, that standard model presents, particles are not fundamental, because their masses are not constant and they are convertible to energy. For instance, electron and positron absorb each other and convert to energy. This phenomenon holds for other fundamental particles in standard model even for photon, because energy photon is variable (for example in gravitational field and Compton effect)) and in pair production, a high-energy photon converts to electron-positron. As the same way, it can be shown that even photon experiences time passing. In fact, a fundamental particle must not experiences time passing, and all other particles are made of it even quantum fields.

Therefore, these properties help us to find fundamental particle in mass–energy equivalence relation $E = mc^2$ and considerable quantity is energy. So paying attention to vacuum quantum remembers this point that quantum energy contains energy and it is acceptable in vacuum (space) between stars at least in existence of gravitational effect. So by looking at behavior of photon in gravitational field, it can be investigated physical properties of gravitational field by paying

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[1] - Matt Visser, What is the 'zero-point energy', SCIENTIFIC AMERICAN, 1997, http://www.scientificamerican.com/article/follow-up-what-is-the-zer/

[2] - Svend Erik Rugh, Henrik Zinkernagel, "The Quantum Vacuum and the Cosmological Constant Problem", 2000, https://arxiv.org/pdf/hep-th/0012253v1

[3] - Werner Karl Heisenberg (1901-1976) a German theoretical physicist

[4] - The Standard Model, http://electron6.phys.utk.edu/phys250/modules/module%206/standard_model.htm

attention to changes in energy of photon in gravitational field and it can be deduced by using the concepts of quantum field about gravitational field that is made of gravitons.

Therefore, the best way to recognize and understand electric and magnetic fields dependent on photon is that we investigate the changes in intensity of these fields in a verified experiment. Now, we do not have a better and more rational experience from behavior of photon in gravitational field that can show these changes. So a new look at behavior of photon in gravitational field and passing from limited and artificial barriers and boundaries of quantum mechanics and relativity can be useful to solve this riddle that a photon has made up from what particles.

2

Review the deeper and hidden layers of sub-atomic world

Since the 19th century, some physicists have attempted to develop a single theoretical framework, which can be applicable for the fundamental forces of the nature-a unified field theory. The classical unified field theories attempt to create a unified field theory based on the classical physics. In particular, several physicists such as Faraday[1], Planck[2]and Einstein[3] actively were pursued unification of the gravitation and electromagnetism. Einstein believed that there was a link between the need to resolve apparent paradoxes of the quantum mechanics and the need to unify electromagnetism and gravity[4]. The classical unified field theories were unsuccessful, but we can unify quantum field theory with gravity by adjusting some concepts of quantum mechanics.

Drop a metal bullet from a height that falls down towards ground. Put a metal disc in the place of reaching the bullet to the ground. When a bullet reaches earth and it hits with the metal disc, it

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[1] - Michael Faraday, “On the possible relation of gravity to electricity” Royal Society 1850. Printed in vol. 141 of the Philosophical Transactions (1851), pp. 1-6

[2] - Brandenburg, J. E., "A Model Cosmology Based on Gravity-Electromagnetism Unification" , Astrophysics and Space Science, Volume 227, Issue 1-2, pp. 133-144 , 1995

Brandenburg, J. E., "Pure EM (Electro-Magnetic) Propulsion and Theories of

Gravity-EM Unification" , 48th AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition 4 - 7 January 2010, Orlando, Florida

http://enu.kz/repository/2010/AIAA-2010-1610.pdf

[3] - Albert Einstein, “Neue Moglichkeit Fur Eine Einheitliche Feldtheorie Von Gravitation Und Elektrizitat”, Journal of the Prussian Academy of Physics, 1928

[4] - Einstein's quest for a unified theory, This Month in Physics History, APS Physics; [Online] available;

http://www.aps.org/publications/apsnews/200512/history.cfm

produces some heat and probably we will observe some sparks, too. Usually, it has been used to justify this phenomenon by physicists that energies are convertible to each other by converting gravitational potential to kinetic energy and conversation law of energy. This justification causes that the nature of this process pays attention and it investigates less from scientific dimension in details and precisely. Nevertheless, let see this experience by a different perspective.

Mystery zero rest mass of the photon

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[1]. Relativistic energy and momentum given by;

$$E = \frac{m_0 c^2}{\sqrt{1 - \frac{\mathrm{v}^2}{c^2}}} \quad and \quad P = \frac{m_0 \mathrm{v}}{\sqrt{1 - \frac{\mathrm{v}^2}{c^2}}}$$

It is just possible that we could allow $m_0 = 0$ provided the particle always travels at the speed of light[2] c. In this case above equations will not serve to define and so that for massless particle given by,

$$E = |P|c$$

As it follows from the Einstein relativistic mass formula:

$$E^2 = m_0^2 c^4 + p^2 c^2 \qquad (2)$$

What does determine the momentum and energy of a massless particle? Not the mass (that is zero by assumption) not the speed (that is always c). Relativity offers no answer to this question, but curiously enough, quantum mechanics does, in the form of Plank's formula:

$$E = mc^2 = hv \Rightarrow m = \frac{hv}{c^2} \qquad (3)$$

[1] - Field, J. (2014). Einstein and Planck on mass-energy equivalence in 1905-06: a modern perspective. arXiv preprint arXiv:1407.8507

[2] - Griffiths, D. (2008). Introduction to elementary particles: John Wiley & Sons, page 89

Only moving photon has mass as follows from the Einstein formula $E = mc^2$. 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[1]. 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[2]. 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[3]. Let's close this window and open new window on concept of particles mass. There are two kinds of particles in physics:

1- Some particles like the photon moves only with the speed of light, in all inertial reference frames. Let's call these kinds of particles as Never at Rest condition particles (NRP).

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

According to the above definitions, photon and graviton are NRP, while electron and proton are particles.

About concept of particle

Generally, we have almost the same understanding and imagination of large objects (at the level of molecules and larger). However, 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. Therefore, any theory offers certain understanding (such as loop and string theories) of these particles. In discussion with my dear friend Daniel, I enjoyed his imagination. He wrote; "...since I consider gravity to be a localized phenomenon with rapid attenuation and to be a space deformation like the rubber sheet of Einstein, I maintain that gravitons are not particles -- indeed, I believe all bosons are a wavelike field phenomena. Even Higgs never proposed a Higgs particle -- he proposed the Higgs Field that "clusters" many wavelets to a denser state. He was a Field Theorist as I am. To me all is field and condensed energy moving wavelets at different frequencies.[4]"

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[1] - Hojman, S. A., & Koch, B. (2013). Closing a window for massive photons. *Advances in High Energy Physics, 2013*

[2] - Heeck, J. (2013). How stable is the photon? *Physical review letters, 111*(2), 021801

[3] - Goldhaber, A. S., & Nieto, M. M. (2010). Photon and graviton mass limits. *Reviews of Modern Physics, 82*(1), 939.

[4] - Daniel Remy Elec. Eng., Physicist, MBA, Principal Physicist at ALPHA-OMEGA PHYSICS RESEARCH http://www.linkedin.com/groups?viewMemberFeed=&gid=1892648&memberID=10044563

Review the deeper and hidden layers of sub-atomic world

The importance of attention to the structure of photon

Something that has been attractive in physics is behavior of light in different environments and their interaction with other particles like electron. Doppler Effect, Photo electric effect Mossbauer Effect, curvature of space… all and all is analyzed without paying attention to Structure of the photon. Something that has been pain attention and accepted by physicists in is that photon (and electron) is a point-like and unstructured particle. Point-like particles are mathematical abstractions with zero size. However, even zero-size particles have an extended effect, due to the effect of the field surrounding them[1].

The only thing that has been investigated in astrophysics and astronomy is the Doppler Effect and red (or blue) shift of the gravitational. The efforts and attempts to recognize and explain the structure of photon is an inevitable necessity. Due to this reason, CPH theory has formed based on a definition from the structure of photon. So how and where we can start to define the structure of photon? .Such a definition must have both logical and experimental support, one of them for valid theories and another for experiments that are consistent with these theories. So, which theory can be helpful? Relativity or Quantum Mechanics?

Citing to both theories is valid, because both of these theories are famous among physicists. Fortunately, these theories have common experimental fields that citing to these common fields can help us to combine and unite both theories. Therefore, we continue to work by these common fields.

Hint: There is much evidence such as the Compton's effect, the pair production, the redshift and blueshift that lead us to accept photon has a structure.

Gravitational effects on electromagnetic waves

According to the general relativity theory, light moving through strong gravitational fields experiences a red- or blue shift. 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 increases (or decreases) from ν to ν' that given by;

$$\nu' = \nu(1 \pm \frac{GM_s}{rc^2}) \qquad (4)$$

G is the gravitational constant; *M* is the mass of the body, *c* is the speed of light, *r* is the distance from the mass center of body. The plus sign refers to blueshift and minus sign refers to redshift.

[1] - Don Lincoln, "What's the point?", Fermilab, https://www.fnal.gov/pub/today/archive/archive_2013/today13-02-15_NutshellReadMore.html

Also in the presence of gravity, the speed of light is not same for all observers. Einstein's derivation of the variable speed of light in a gravitational field potential[1] as follow:

$$c' = c(1 \pm \frac{GM_s}{rc^2}) \qquad (5)$$

Where c is the speed of light in vacuum and c' is the speed of light in gravitational field. It should be noted that there is no consensus about the speed of light in a gravitational field. For examples; so in the presence of gravity the speed of light becomes relative (variable depending on the reference frame of the observer). This does not mean that photons accelerate or decelerate; this is just gravity causing clocks to run slower and rulers to shrink[2]. The problem here comes from the fact that speed is a coordinate-dependent quantity, and is therefore somewhat ambiguous. To determine speed (distance moved/time taken) you must first choose some standards of distance and time, and different choices can give different answers. This is already true in special relativity: if you measure the speed of light in an accelerating reference frame[3], the answer will, in general, differ from c. Based on the Schwarzschild solution of the Einstein's equation of gravitational field, it is proved that the speed of light would change and the isotropy of light's speed would be violated in gravitational field with spherical symmetry[4].

The problems caused by the lack of attention to the structure of photon and relationship between energy and frequency of it. It will be discussed in next sections.

The change of frequency of the photon in the gravitational field has been demonstrated by the Pound-Rebka experiment. The Pound–Rebka experiment is a well-known experiment to test Albert Einstein's theory of general relativity in 1959. The result confirmed the predictions of general relativity[5].

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[1]- To see the steps how Einstein theorized that the measured speed of light in a gravitational field is actually not a constant but rather a variable depending upon the reference frame of the observer: Einstein wrote this paper in 1911 in German:
http://www.physik.uni-augsburg.de/annalen/history/einstein-papers/1911_35_898-908.pdf
http://www.speed-light.info/speed_of_light_variable.htm

[2] - Variable Speed of Light, http://www.speed-light.info/speed_of_light_variable.htm

[3] - Philip Gibbs, Is The Speed of Light Constant? 1997,
http://www.desy.de/user/projects/Physics/Relativity/SpeedOfLight/speed_of_light.html

[4] - Mei Xiaochun, "A Test to Verify the Change of Light's Speed in the Gravitational Field of the Earth" https://arxiv.org/ftp/physics/papers/0611/0611294.pdf

[5]-Pound, R. V.; Rebka Jr. G. A. "Apparent weight of photons". *Physical Review Letters* 4 (7), 1960

Review the deeper and hidden layers of sub-atomic world

The Pound–Rebka experiment

A photon with mass $m = \frac{hv}{c^2}$ has weight as $= \frac{hv}{c^2} g$, in gravitational field. When photon falls a distance equal y toward the earth, according to conservation law of energy we have:

$$hv' = hv + mgy = hv + \left(\frac{hv}{c^2}\right) gy \qquad (6)$$

$$v' = \left(1 + \frac{gy}{c^2}\right) v \qquad (7)$$

If we consider this phenomenon as another evidence to verify the general relativity, we will be stopped in the same old theories. Therefore, if we want to get a different result, we have to change our thoughts. The work that gravitational force does on the photon does not mean a simple concept of increasing in kinetic energy, but some deeper and more profound concepts are hidden beyond it. If we want to look at this phenomenon from the point of view of quantum field theory, we must accept that gravitons penetrate to the structure of the photon and in addition to the increasing its energy cause increasing electric and magnetic field intensity. Nevertheless, by considering the accepted concepts of quantum mechanics for gravitons, this phenomenon is not justifiable. Therefore, we need to reconsider the concepts of quantum mechanics about graviton and investigate about this phenomenon beyond quantum mechanics.

A new definition of graviton

According to interaction between graviton and photon, we can redefine the graviton. Consider a photon is escaping from a strong gravitational field like a black hole. Suppose that a photon with energy $E = hv$ is escaping of gravitational field. Secondary frequency of photon is given by following equation:

$$v' = v(1 - \frac{GM}{rc^2}) \qquad (8)$$

Photon has spin and includes two perpendicular electric and magnetic fields. By reducing the frequency of photon (photon energy reduction), intensity of electric and magnetic field are reduced too and finally, intensity of both the fields reaches to zero and the photon loses all its energy. Final limit for energy of photon before that reaches or tends to zero and still has spin, is equal to the energy of graviton E_G *or* $E_{graviton}$, so that:

$$E_G < hv, \forall\, v\ detectable \qquad (9)$$

Similarly, the mass of the graviton m_G *or* $m_{graviton}$ is given by:

$$m_G < \frac{h\nu}{c^2} \ , \forall\, \nu \ detectable \qquad (10)$$

However, both of the above equations (9) and (10) do not show some intuitive value and assessable. In addition, the above equations do not have not any specific information about electric and magnetic fields associated with photon. Therefore, we should be looking for an intuitive experience to be able to achieve tangible values and find out that how to produce electrical and magnetic fields associated with the photon. Our approach for such this election is changing the photon energy in a gravitational field that is associated with the intensity of electric and magnetic fields of photon. It means that gravity works on the photon and gravitons enter to the structure of the photon in which it is justified according to the following equation:

$$F = -\frac{dU}{dx} \qquad (11)$$

Where dU changing potential energy at small distance dx and F is the force. Now we should explain the process of changing energy (equation 6) by using equation (11). Photon falls at specified distance dy in gravitational field and its potential energy is reduced to dU (its kinetic energy increases). Reduction in potential energy of photon means that its frequency and kinetic energy increases that is given by $d\nu$ and $dE = hd\nu$ respectively. From the perspective of quantum mechanics, that photon unstructured, it is impossible to explain this phenomenon. Therefore, if we want to analyze the structure of photon, we must pass the quantum space and enter into sub quantum space. From the perspective of sub quantum space, a number of gravitons enter into photon structure that is justified by equation (11), and the energies of gravitons is added to the energy of photon. Now the question is how many gravitons enter into the structure of photon that generates the smallest possible change of energy that is given by $dE = hd\nu$? Also changing in energy of photon is associated with changing in intensity of electric and magnetic fields. Therefore, the work done on the photon by gravity must be discussed in such a way that justifies changing in intensity of electric and magnetic fields. Due to this reason in the CPH Theory, gravitons have properties that when gravity works on photon, can alter the intensity of electric and magnetic fields of the photon. This attitude led to the terms color-charge and magnetic-color in which they have used to define gravitons. In other words, identity of graviton changes without any change in its energy.

Review the deeper and hidden layers of sub-atomic world

Color-charges and magnetic-color

Now we are in a position that are able to take a new look at the structure of photon and define the features and properties of graviton in a way that is compatible with the feature of photon, and it is in accordance with experimental conditions very well. A photon with the lowest possible energy also carries electric and magnetic fields. Therefore, the features of gravitons entered into the structure of the photon must behave in a way that along with explaining the energy of photon, describes increasing in intensity of electric and magnetic fields. In other words, some of these gravitons cause increasing the electric field of photon and some other gravitons increase the intensity of magnetic fields. Also, not only a photon at lowest level of its energy is formed by some of the gravitons, but also its formed members have electric and magnetic properties that is called color-charge and magnetic-color in CPH theory. The next step is to specify color-charges and magnetic-colors in which it is obtained by paying attention to at least change in energy of photon in a gravitational field while moving into blue shift of gravity.

Formed elements of photon:

Suppose a photon with NRP mass $m = h\nu/c^2$ and energy $E = h\nu$ falls from high h toward the earth relative to an inertial reference frame on the surface. Its frequency increases from ν to ν' , in fact, a number of gravitons enter into the structure of the photon such that $\Delta\nu = \nu' - \nu$. So the problem is; how many gravitons enter into the structure of photon to provide at least possible change of the energy of photon (minimum $\Delta\nu$)? So if $\Delta\nu$ is minimum, then how many gravitons has entered into the structure of photon? What properties gravitons must have that they can be compatible with photons identity? For finding properties of gravitons and analyzing this process, we must observe these following conditions:

Condition1: photon is carrying two perpendicular electric field and magnetic field.

Condition2: The photon is electrically neutral and particles forming the electric field must neutralize each other.

Condition3: There is two groups positive and negative color-charges in structure of photon that form photon's electric field and neutralize each other.

Condition4: Because these electric fields are moving, they create magnetic fields around themselves.

Condition5: simultaneously by producing positive and negative electric fields, two magnetic fields are produced around the electric fields do form. Therefore, it will be made two groups of magnetic-colors.

The above features necessitate that we consider each photon including four groups, two groups carry positive and negative effects and two groups carry magnetic effects.

Suppose that a photon with frequency ν and energy $h\nu$ is formed of n_1 elements, so that:

$$n_1 = n_{11} + n_{12} + n_{13} + n_{14}$$

Moreover, this photon with frequency ν' and energy $h\nu'$ is formed of n_2 elements, so that:

$$n_2 = n_{21} + n_{22} + n_{23} + n_{24}$$

For two levels of energy $h\nu'$, $h\nu$, we form the below matrices:

$$h\nu = \begin{bmatrix} n_{11} & n_{12} \\ n_{13} & n_{14} \end{bmatrix} \qquad (12)$$

$$h\nu' = \begin{bmatrix} n_{21} & n_{22} \\ n_{23} & n_{24} \end{bmatrix} \qquad (13)$$

Now, we consider the matrix of changing energy of photon $\Delta E = h\nu' - h\nu$ as follow:

$$\Delta E = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \qquad (14)$$

Matrices (12, 13 and 14) must satisfy the following equation:

$$h\nu' = \begin{bmatrix} A & B \\ C & D \end{bmatrix} + \begin{bmatrix} n_{11} & n_{12} \\ n_{13} & n_{14} \end{bmatrix} = \begin{bmatrix} n_{21} & n_{22} \\ n_{23} & n_{24} \end{bmatrix} \qquad (15)$$

According to conditions (1-5), it will be determined elements A, B, C, D. We consider the first row of the matrix 14, the elements of A, B for negative and positive colors charges. Element A represents positive color-charges and element B represents negative color-charges. In interaction between gravitons and photons, photon falls at specified distance dy and its energy increases (Equation 4) that due to equation (11) the identity of a number of gravitons change by carrying gravitational force towards color-charges and enter to the structure of photon. We use the symbol of graviton G, for the both negative color-charge as G^- and positive color-charge as G^+, so that:

$$A = \text{к}\, G^+ , \qquad B = \text{к}\, G^-$$

Where κ is a natural number. In other words, when gravity does the work on photon, a number of gravitons enter into the structure of photon and photon's intensity of electric field increases, without any electrically effect and it is not created electric charge, because the photon is electrically neutral. So A, B must carry electric effect and their numbers must be equal (conditions2 and 3).

Also according to the relative intensity electric fields and magnetic of electromagnetic waves $\boldsymbol{E} = c\boldsymbol{B}$, since color-charges and magnetic-colors are carrying electric and magnetic fields that they are NRP and countable, therefore, this relative can be replacement by a natural number such as κ, so we have $\boldsymbol{E} = \kappa\, \boldsymbol{B}$. When a number G^+ enter into photon structure, intensity of positive electric field of photon increases. Therefore, according to Maxwell's electromagnetic equations, the intensity of magnetic field increases, too. Therefore, the element C (equation14) must increases the intensity of magnetic effect around the positive color-charges. Similarly, the element D must increases the intensity of magnetic field around the negative color-charges. The effect of these two elements are the same, but in terms of direction (which is proportional to the electric field) are different. Thus, according to the electric and magnetic field intensity we can be written:

$$\boldsymbol{C} = \boldsymbol{G_m^+}\,, \qquad \boldsymbol{D} = \boldsymbol{G_m^-}$$

The negative sign in relation $D = \boldsymbol{G_m^-}$, only determines the direction of magnetic colors around the negative color-charges. So matrix (14) that is called the CPH matrix, will be as follows:

$$CPH = \begin{bmatrix} \kappa\, G^+ & \kappa\, G^- \\ G_m^+ & G_m^- \end{bmatrix} \qquad (16)$$

According to the above expression, we are now able to define the least magnitude of a photon. A photon of minute energy contains some positive color-charges $\boldsymbol{G^+}$, negative color-charges G^- , right rotation color-magnetic G_m^+ and left rotation color-magnetic $\boldsymbol{G_m^-}$ as shown in the CPH matrix (equation 16). This very small energy can be express as the following;

$$\text{Minute electromagnetic energy: } E_{Minute} = (2\kappa + 2)E_G \qquad (17)$$

Thus, each photon is formed of a natural number E_{Minute}, so we have;

$$E = n(2\kappa + 2)E_G \text{ , or } \quad E = n\begin{bmatrix} \kappa\, G^+ & \kappa\, G^- \\ G_m^+ & G_m^- \end{bmatrix} \qquad (18)$$

Equations (9) and (10) have previously defined the mass and energy of graviton. The longest wavelengths of radio production and broadcasting by radio stations is the world's longest wavelength which is equal to 10,000 km. Using the equation $m = h\nu/c^2$, the mass such photon is less than $10^{-55}\,kg$. By comparing this value with the electron mass that is equal to $9.1 \times 10^{-31}\,kg$, and in the pair production a high-energy photon converts to an electron and a positron, each photon is containing billions and billions of gravitons.

Speed of graviton

Einstein proposed the speed of light by special relativity theory. In this theory the speed of light in inertial frame of reference is constant "*c*", and also it is the limit rate of speed. In General Relativity, the speed of light is not constant (equation 5). Reconsidering the principles of Special Relativity sometimes associated with new questions such as, whether the constancy of the speed of light is a natural law or a natural accident. As the equation (5) shows, whether there is no limit to speed of light in General Relativity. Whether can the speed of light continue to infinity, like speed in classical mechanics?

The important concept in relationship between 'mass' and energy is *c*, regarding the phenomena of creation and decay of electron-positron pairs, why do the related photons move at constant speed, but we could change the speed of matter and antimatter? What is the unique characteristic of matter, which is convertible to photons that move with constant speed *c* (speed of light)? The idea that object/particle could not travel at superluminal speeds, originates from the structure of matter and the mechanism of interaction between field and mass; that with presenting a postulate we could generalize the constancy of speed from energy to mass.

By gravitational blueshift, the energy of photon and consequently its frequency will increase. What is the mechanism of increasing in the photon energy that causes increase in its frequency? Are there more results than before in the energy-mass equivalence relation?

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. Therefore, the amount of passed path per unit of time is not equal *c* and it is greater than *c*, in the other word graviton moves faster than light 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, is faster than light speed, so $V_G > c$, that V_G is the total speed of transmission speed V_{GT} and non-transmission V_{GS} of graviton or color-charge and magnetic-color (figure1).

$$|V_G| = |V_{GT}| + |V_{GS}| > |c| \qquad (19)$$

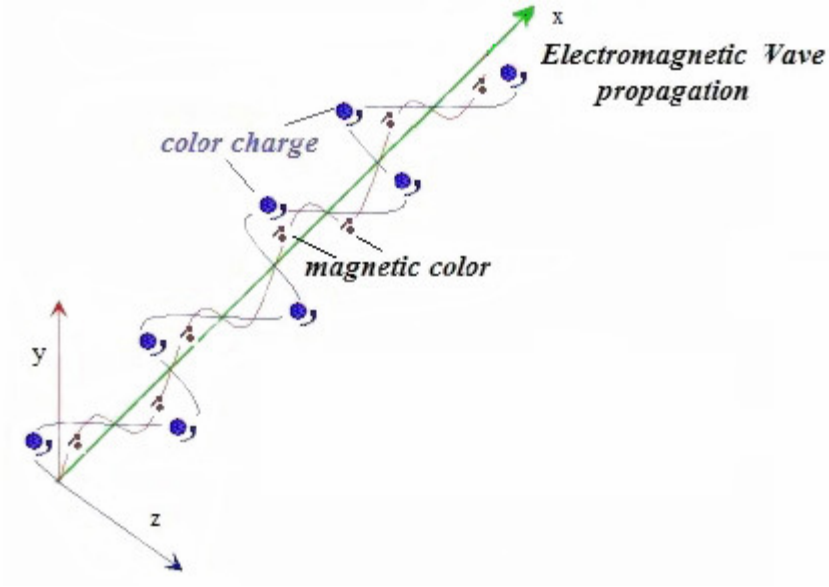

Fig1; paths of gravitons in photon structure, color-charges and magnetic-color have spin and curvature speed

By presenting the graviton principle, the reverse of above process will be done to see how elementary particles like electrons and photons do form, and then we could describe the mechanism of the production of electromagnetic field, the strong and weak field.

Graviton Principle

Graviton is the most minuscule unit of energy with constant NRP 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 $\boldsymbol{I}$ where the magnitude of V_G remains constant and never changes. Therefore;

$$\nabla V_G = 0 \text{ , in all inertial reference frame and any space} \qquad (20)$$

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 E_{GT} and the other one is non-transmission energy E_{GS} , So that;

$$E_G = E_{GT} + E_{GS} = constant \qquad (21)$$

As the graviton mass and speed is constant, its energy remains constant and can only its transmission energy changes to non-transmission energy and vice versa. Gravitons convert to energy and energy converts to matter and anti-matter. In fact, everything has been formed of graviton.

Sub-Quantum Energy (SQE)

We use CPH matrix (equation16) to define sub quantum energy (SQE). The first column of CPH matrix is defined positive sub quantum energy SQE^+ and the second column of CPH matrix is defined negative sub quantum energy SQE^- , so;

$$\text{Positive Sub Quantum Energy: } SQE^+ = \begin{bmatrix} \kappa G^+ \\ G_m^+ \end{bmatrix} \qquad (22)$$

$$\text{Negative Sub Quantum Energy: } SQE^- = \begin{bmatrix} \kappa G^- \\ G_m^- \end{bmatrix} \qquad (23)$$

The amount of speed and energy of positive and negative sub quantum energies are equal, and the difference between $SQE^+ \; and \; SQE^-$ are only in the sign of their color-charges and magnetic-color flow direction. So, sub quantum energy (regardless of sign, positive or negative) can be defined as follows:

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

$$SQE = h\nu_{least,} \;\; \nu_{least} < \nu, \forall \; E = h\nu, \text{where } E = h\nu \text{ is detectable} \qquad (24)$$

By comparing the equations (9) and (24), and definition of the sub quantum energy is determined $E_G < SQE$, and according to the equations (18) and (24) each photon is formed of the equal number of positive and negative sub quantum energies, and for even number n can be written:

$$E = nSQE, \;\; \text{where } n \text{ is a natural number} \qquad (25)$$

$$E = nSQE = nm_{SQE}c^2 = n\big(m_{SQE}c\big)c = np_{SQE}c \;\Rightarrow E = np_{SQE}c \qquad (26)$$

For two photons with energies E_1, E_2 we have;

$$E_2 = h\nu_2 = n_2 SQE, E_1 = h\nu_1 = n_1 SQE, E_2 > E_1 \Rightarrow n_2 > n_1, n \propto \nu \qquad (27)$$

Here, 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 increasing and frequency increasing. Therefore, based on *SQE* definition and equation (27) we can relate the relation between photon's energy and frequency and the interaction between *SQE*s in a photon's structure, i.e. with increasing the number of *SQE*s in photons, the interaction between *SQE*s in photons will increase and the frequency that originates from the interaction between *SQE*s will increase, too.

Note: Although $n \propto \nu$, this proportion does not necessarily represent an equation, but simply represents the physical fact that frequency has direct relation with the number and interaction of *SQE*s in a photon. Besides the relation between *SQE*s and ν, could conclude that the linear speed of *SQE* in a vacuum relative to the inertial frames of reference, is actually the speed of light *c*. Since *SQE* in a photon's structure has a linear speed equal to *c* and 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 (equation5); that we could take it as a proof of $|V_{SQE}| > |c|$.

$$|V_G| > |V_{SQE}| > |c| \qquad (28)$$

Sub-Quantum Energy Principle

One *SQE* is a very small energy with *NRP* 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;

$$\nabla V_{SQE} = 0 \text{ , in all inertial reference frames and any space} \qquad (29)$$

SQE principle (equation 29) 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. So, we have;

$$|V_{SQE}| = |V_{SQET}| + |V_{SQES}| = constant \qquad (30)$$

$$|E_{SQE}| = |E_{SQET}| + |E_{SQES}| = constant \qquad (31)$$

Virtual Photon & Quantum Vacuum Energy

In contrast to classical mechanics, in quantum mechanics, the vacuum is not empty and it has energy. A quantum fluctuation is the temporary change in the amount of energy in a point in space, as explained in Werner Heisenberg's uncertainty principle[1]. Heisenberg uncertainty equation is obtained by multiplying the energy uncertainty ΔE and time uncertainty Δt is always greater than zero[2] that is given as follow;

$$\Delta E \cdot \Delta t \geq \frac{\hbar}{2} \qquad (32)$$

Where $\hbar = \frac{h}{2\pi}$ and h is Planck constant. Based on quantum field theory, the quantum vacuum is filled with virtual particles which are in a continuous state of fluctuation. Virtual particle-antiparticle pairs are created from vacuum and annihilated back to it. These virtual particles exist for a time dictated by Heisenberg uncertainty relation[3]. If the zero point energy in space (vacuum) exists, how can we explain the zero-point energy without using the uncertainty principle?

Following the success of the theory of relativity and quantum mechanics, the theory of relativistic charged particles interacting with electromagnetic fields was formulated.

In the perturbative approach to quantum field theory, the full field interaction terms are approximated as a perturbative expansion in the number of particles involved. Each term in the expansion can be thought of as forces between particles being mediated by other particles. In QED, the electromagnetic force between two electrons is caused by an exchange of photons[4]. Richard Feynman devised a short hand way of writing out particle interactions called Feynman Diagrams. Under QED, charged particles interact by the exchange of virtual photons, photons that do not exist outside of the interaction and only serve as carriers of momentum/force[5].

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[1] - Brandon West, "Vacuum Energy: Proof of Free Energy in the Space All Around Us" WakingTimes, 2014, http://www.wakingtimes.com/2014/04/11/vacuum-energy-proof-free-energy-space-around-us/

[2] - Uncertainty and Virtual Particles, https://pdg.web.cern.ch/pdg/cpep/unc_vir.html

[3] - H. Razmi and S. M. Shirazi, "Is the Free Vacuum Energy Infinite?" https://arxiv.org/ftp/arxiv/papers/1302/1302.1433.pdf

[4] - Mario Bunge, "Virtual Processes and Virtual Particles: Real or Fictitious?" International Journal of Theoretical Physics, Vol. 3, No. 6 (1970), pp. 507-508

[5] - http://abyss.uoregon.edu/~js/21st_century_science/lectures/lec17.html

Review the deeper and hidden layers of sub-atomic world

Is there a relationship between quantum vacuum energy processes and the interactions of charged 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? If a charged particle as a generator has an output known as a virtual photon, what will be its input?

QED rests on the idea that charged particles (e.g., electrons and positrons) interact by emitting and absorbing photons, the particles of light that transmit electromagnetic forces. These photons are virtual; that is, they cannot be seen or detected in any way because their existence violates the conservation of energy and momentum[6]. If the electromagnetic field is defined in terms of the force on a charged particle, then it is tempting to say that the field itself consists of photons which cause a force on a charged particle by being absorbed by it or simply colliding with it-as in the Photo-electric effect. The electric repulsion between two electrons could then be understood as follows: One electron emits a photon and repels; the second electron absorbs the photon and acquires its momentum. Clearly the repel of the first electron and the impact of the second electron with the photon drive the electrons away from each other. This is because of repulsive forces. How can attraction be represented in this way? The uncertainty principle makes possible to describe. The attraction between an electron and a positron may be described as follows: the electron emits a photon with momentum directed away from the positron and thus repels towards the positron. This entails a degree of understanding in the momentum of the photon. There must be a corresponding uncertainty in its position-it could be on the other side of the positron so that it can hit it and knock it towards the electron[7]. Is there a way to explain virtual photon (in fact interaction between charged particles) without using the uncertainly principle?

These ambiguities in mathematics calculation are due to lack of attention to the structure of photon and mode of electromagnetic energy production. In fact, by describing the quantum vacuum energy and generalization the Maxwell's equations of electromagnetism to gravity, we can describe the mechanism of quantum vacuum energy and the production of electric fields process by charged particles.

Virtual Photon from Sub-Quantum Point of View

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 gravitons equations 16 to 18). 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

[6] - Quantum Electrodynamics
http://abyss.uoregon.edu/~js/glossary/quantum_electrodynamics.html

[7] - Feynman Diagrams and Forces Between Particles
http://voyager.egglescliffe.org.uk/physics/particles/parts/parts1.html

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 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:

$$\boldsymbol{\nabla \times E_G} = -\frac{\partial \boldsymbol{G_E}}{\partial t} \Leftrightarrow i(\boldsymbol{G^+}, \boldsymbol{G^-}) \qquad (33)$$

By changing the photon electric field, magnetic field also changes. 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;

$$\boldsymbol{\nabla \times B_G} = \mu_0 \varepsilon_0 \frac{\partial \boldsymbol{E_G}}{\partial t} \Leftrightarrow j(\boldsymbol{G_m^+}, \boldsymbol{G_m^-}) \qquad (34)$$

Where $i,\ j$ are natural numbers, and proportion between $i\ and\ j$ should be consistent with equation (18). Assume that $2k$ positive and negative color-charges (kG^+, kG^-) enter the a 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 (equations 22, 23). 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)[8] that is given by the following equation:

$$r_g = \frac{m v_\perp}{|q|\mathbf{B}} \qquad (35)$$

Where r_g is the gyro radius, 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 $\boldsymbol{B}$ 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 the color-charges change in the structure of a photon, then the magnetic-color changes, too. Therefore, the electric fields do not decay in the structure of photon. In general, we are able to describe the sub quantum energy (SQE), virtual photons and real photon as follows:

[8] - Francis F, & Chen, "*Introduction to Plasma Physics and Controlled Fusion*", Plenum Press. 1984

Review the deeper and hidden layers of sub-atomic world

1- **Positive Sub Quantum Energy (SQE^+):** The positive sub quantum energy (equation 22) is a set of positive color-charges with its affiliates magnetic-color that is shown by right wedge $\triangleright$ (the first column of the CPH matrix, equation 16), which is defined as follows:

$$\text{Positive Sub Quantum Energy } \boldsymbol{SQE^+}: \triangleright = \begin{bmatrix} \kappa \boldsymbol{G^+} \\ \boldsymbol{G_m^+} \end{bmatrix} \qquad (36)$$

2- Negative Sub Quantum Energy (SQE^-): The positive sub quantum energy (equation 23) is a set of negative color-charges with its affiliates magnetic-color that is shown by left wedge $\triangleleft$ (the second column of the CPH matrix, equation 16), which is defined as follows:

$$\text{Negative Sub Quantum Energy } \quad \boldsymbol{SQE^-}: \triangleleft = \begin{bmatrix} \kappa \boldsymbol{G^-} \\ \boldsymbol{G_m^-} \end{bmatrix} \qquad (37)$$

Virtual photons: there are two types of virtual photons, positive virtual photon γ^+ and negative virtual photon γ^- that each of them is formed of number same-sign sub quantum energies, which is defined as follows:

$$\text{Positive virtual photon; } k \triangleright = \gamma^+ \qquad (38)$$

$$\text{Negative virtual photon; } k \triangleleft = \gamma^- \qquad (39)$$

A real photon is formed of a positive virtual photon and a negative virtual photon:

$$\gamma^+ + \gamma^- = \gamma \qquad (40)$$

$$(n \triangleright + n \triangleleft) = n(\triangleright + \triangleleft) \; or \; n|\triangleright\rangle + n|\triangleleft\rangle = \gamma \qquad (41)$$

Where, n , k are natural numbers. So far, the production of electromagnetic energy (photons) was described by using gravitational blueshift, in reverse phenomena photons decay to negative and positive virtual photons. In redshift, virtual photons also decay to positive and negative sub quantum energies (SQEs), and sub quantum energies (SQEs) decay to color-charges and magnetic-colors, too. Color-charges and magnetic-colors away from each other, lose their effect on each other and become gravitons.

Light Speed

According to the principle of Special Relativity, the speed of light in vacuum is constant and it equals to *c* for all inertia observers, and it is independent of the light source. How we can conclude this principle by using sub quantum energy principle? First, according to principle of SQE (which is also the result of the graviton principle) the amount of the linear speed of SQE depends to the interaction between $SQEs$ and the other particles (or fields) in the medium. So, in a vacuum, photon (light) has not any interaction with other particles or fields outside of the photon structure, (assume gravitational effect of vacuum is negligible), thus, the linear speed of *SQEs* in the structure of photons are constant and equal to $V_{SQET} = c$. Also, the linear speed of virtual photons in a vacuum is the same amount of *c*. Let's in generally, show the speed of photons as v_{light}, it changes from one environment to another that in a vacuum is *c*, it means the speed of light in vacuum also is $\mathrm{v}_{light} = c$. So that:

$$\nabla \mathrm{v}_{light} = 0 \qquad (42)$$

Thus, the linear speed of photon depends to environmental conditions. Same as gravitons and sub quantum energy, but the total amount of transmission speed v_{lightT} and non-transmission speed v_{lightS} of photon is constant and it is equal to $|\mathrm{v}_{light}|$, by changing the environmental conditions, such as photon enters to water, a part of its linear speed converts to non-linear speed and in this case we have $\mathrm{v}_{lightT} < c$. But this effect is not permanent, because the environment conditions (with any physical and chemical conditions) cannot affect the amount speed of v_{light}, and environment only can temporarily changes linear motion to non-linear motion and vice versa. That is why as soon as the light comes out of the water environment; the new environment will be affected on it. So we can write:

$$|\mathrm{v}_{light}| = |\mathrm{v}_{lightT}| + |\mathrm{v}_{lightS}| = constant \qquad (43)$$

As the principle of sub quantum energy shows, the total transmission speed and non-transmission speed of SQE is always constant relative to the inertial reference frame and it is an intrinsic property of nature, which is also affected by the graviton principle, because SQE of gravitons are made. So the amount transmission speed (in this case linear velocity) of SQE is independent of emitter source of light. On the other hand, photon is made up of positive and negative $SQEs$ (equation 25), so the linear speed of photon depends to linear speed of $SQEs$ that in vacuum is *c (like the speed of light in water or any other medium)*. But in the liquid (e.g. water)

it is less than *c,* and under the influence of the gravitational field, according the direction of gravity force is applied, this amount varies and it can be more or less than the speed of light in a vacuum (equation 5). So the speed of light in a vacuum is constant and it is equal to *c* for all the inertia observers, but in accelerating frame, as well as Einstein's General Relativity has made clear, is not constant (equation 5), and obeys presented as follows:

$$c' = c(1 \pm \frac{GM_s}{rc^2})$$

Now the question arises that how much change will increase or decrease the speed of light? The answer to this question is given later (see singularity section).

3

Review the hidden layers of Quantum Interactions

Zero Point Energy (ZPE)

Space is full of gravitons and graviton is a basic element to produce energy. There is no physical point in space devoid of gravity effect. Therefore, at any physical point in the space, there are energy production facilities. 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 $G^-, G^+, \boldsymbol{G_m^-}, \boldsymbol{G_m^+}$, and electromagnetic energy acts only as a catalyst. 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. But the amount of electromagnetic energy in space depends to density of gravitons $\rho(G)$ in the space. Therefore, the integral on space compared to the density of gravitons, namely:

$$E = \oiiint \rho(G)dV = n(\kappa G^+, \kappa G^-, G_m^+, G_m^-) \qquad (44)$$

Where V is volume. According to equations (35 to 40) we can describe the mechanisms of zero-point energy production. When the density of graviton increases in space, a number of gravitons with the NRP mass (m_G) are adjacent to each other and interactions are logged and they are converted to color-charges and a number gravitons convert to magnetic-color. Finally, sub quantum energies produce virtual photons, and virtual photons form the real photon. About the vacuum energy, even in the absence the photons in vacuum, the Maxwell's equations can be generalized in vacuum. Equation (33) comes in just below, but the equation (34) remains as before.

Review the hidden layers of Quantum Interactions

$$\nabla \times \boldsymbol{G}_E = -\frac{\partial \boldsymbol{G}}{\partial t} \Leftrightarrow i(\boldsymbol{G}^+, \boldsymbol{G}^-) \qquad (45)$$

In equation (45), ∂G shows even without the electric field, when the density of graviton increases in space, gravitons interacting with each other and they acquire electrical field and magnetic and they produce the electromagnetism energy. According to the above description and with regard to the phenomenon of gravitational redshift and blueshift, in general it can be concluded that:

$$\text{Gravitational energy} \Leftrightarrow \text{Electromagnetic energy} \qquad (46)$$

If we reconsider to the gravitational redshift of a black hole, photon loses all its energy in escaping and eventually reaches to $\nu' = 0$ (Equation 4), and there is no energy in photon structure to escape of black hole. In fact, all the photon's energy is converted into gravitons.

Hawking Radiation

In a simplified version of the explanation, Hawking[1] predicted that energy fluctuations from the vacuum cause the generation of particle-antiparticle pairs near the event horizon of a black hole. One of the particles falls into the black hole while the other escapes before they have an opportunity to annihilate each other[2]. The net result is that to someone viewing the black hole, it would appear that a particle has been emitted.

How is Hawking radiation explainable by the equation (44) for the ZPE? To resolve this problem, there are three aspects of a black hole to be considered;

•The density of gravitons is extremely high around a black hole.

• Gravitons convert to photons rapidly.

• The Dirac equation shows how photons produce matter and anti-matter.

According to the above expression, the space around a black hole produces high energy photons whose energy is enough for pair production.

In a black hole situation, *n* becomes large, so, *E* (equation 44) is comparable to the total mass of a particle and anti-particle. This process does not need to take into account the time factor that

[1] - Stephen William Hawking (1942-) an English theoretical physicist and cosmologist

[2] - BLACK HOLE THEORY & HAWKING RADIATION, The Physics of the Universe http://www.physicsoftheuniverse.com/topics_blackholes_theory.html

the uncertainty principle dictates in equation (32). So, pair production is a common occurrence around a black hole. Yet even without heavy nuclei collide to produce a pair of photons - photons[3].

Spin of Graviton

In standard model, the graviton is a massless particle and it must have a spin of 2 which moves with the speed of light[4]. "We cannot solve problems by using the same kind of thinking we used when we created them." Einstein said[5]. To solve old problems, new ideas are needed. In the previous sections we have discussed about the speed of graviton and it was shown that the graviton should have speed higher than the speed of light. It was explained that the graviton is a NRP (Never at rest condition particle), so it is inappropriate to speak about rest mass of graviton. But about the graviton spin, we should be caution about the spin of the graviton and not a final verdict, because there is difference between a free graviton (in the far distance of objects and particles) and a graviton that is interacting with other particles.

Pair production and decay shows that a photon with spin one converts to two particles (electron and positron)[6] with spin $1/2$. In quantum physics, it usually is used the new observing phenomena for confirming valid theories, only - in this case the pair production verification E and Dirac equation - and not think beyond that. The amount speed and energy of graviton is constant (equations 20 and 21), but by changing the amount transmission energy and speed of graviton, also altered the identity of its spin, without changing the total amount of its speed and energy.

In relativistic quantum mechanics, the problem is that Dirac equations cannot explain virtual pair production and decay in a vacuum. That's why uncertainty principle is used to justify the virtual pair production and decay in vacuum[7]. Richard Feynman propounded the behavior of elementary particles calculation in series diagrams that is called Feynman diagrams[8] that includes also virtual pair production and decay of the vacuum[9].

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[3] - Robert J. Gouid, "Pair Production in Photon-Photon Collision", Physical Review, Volume 155, Number 5, 1967,
http://fcaglp.fcaglp.unlp.edu.ar/astrofrelat/astrofisica/media/Papers/Gould_Schreder_1966.pdf

[4] - Feynman, Richard, "Feynman Lectures on Gravitation."
https://www.fourmilab.ch/documents/reading_list/indices/book_888.html

[5] - http://www.brainyquote.com/quotes/quotes/a/alberteins121993.html

[6] - Electron-positron Annihilation and Pair Creation & Compton Scattering
https://teachers.web.cern.ch/teachers/archiv/HST2002/Bubblech/mbitu/electron-positron.htm

[7] - Uncertainty Principle, http://abyss.uoregon.edu/~js/21st_century_science/lectures/lec14.html

[8] - For Feynman diagram see; http://www-pnp.physics.ox.ac.uk/~barra/teaching/feynman.pdf

[9] - There is many reasons that why Feynman diagrams is propounded to see resources below for a closer study.
Shirkov, D. V. Fifty years of the renormalization group, CERN COURIER
http://cerncourier.com/cws/article/cern/28487
Patricia Schwarz, Why did string theory enter to story? http://www.superstringtheory.com/basics/basic3a.html

Review the hidden layers of Quantum Interactions

With all the effort that was undertaken in recent decades on QED, there is a fundamental question that has never been raised or if it has raised (we have not seen) is ignored. In modern physics, a charged particle emits and absorbs energy, but its mechanism is not described. So the question is; if the photon is an unstructured particle, with zero rest mass and no electrical charge (and neutral), how charged particles absorb and radiate it? There are many articles that show, photon has upper limit mass[10] and electric charge[11], which are consistent with experimental observations. However, in CPH theory photons are combination of positive and negative virtual photons. Photon is a very weak electric dipole that is consistent with the experience and these articles are asserted. In addition, this property of photon (very weak electric dipole) can describe the absorption and emission energy by charged particles.

Pair production and decay

In the process "pair production of electron - positron", the total relativistic conservation of energy law, conservation of momentum and conservation of electric charge must be held. The conservation of momentum law shows that a photon cannot disappear in a vacuum (empty space) and produce pair. Because such a process is possible by presence of a massive nucleus such that the momentum of the photon and conservation of momentum is not to be violated. Equation (2) is the relation of "energy-mass and momentum in special relativity" and in the special case for a particle at rest (i.e.$P = 0$) is reduced to $E^2 = m^2c^4$ in which the relation between mass and energy is in the Hamiltonian Dirac [12] equation that is solved and given by:

$$E = \pm mc^2 \,, \rightarrow \; E_+ = +mc^2 \,, E_- = -mc^2 \qquad (47)$$

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[10] - Heeck, J. (2013). How stable is the photon? Physical review letters, 111(2), 021801

Liang-Cheng Tu, Jun Luo and George T Gillies, "The mass of the photon" Rep. Prog. Phys. 68 (2005) 77–130 , doi:10.1088/0034-4885/68/1/R02

Antonio Accioly, Jos´e Helay¨el-Neto, and Eslley Scatena, "Upper bounds on the photon mass", Phys.Rev.D82:065026,2010, DOI: 10.1103/PhysRevD.82.065026

[11] - Giuseppe Cocconi, "Upper limit for the electric charge of the photons from the millisecond pulsar 1937+21 observations" Physics Letters B Volume 206, Issue 4, 2 June 1988, Pages 705–706

http://www.sciencedirect.com/science/article/pii/037026938890723X

V. V. Kobychev and S. B. Popov, "Constraints on the Photon Charge from Observations of Extragalactic Sources" Astronomy Letters, Vol. 31, No. 3, 2005, pp. 147–151.

http://xray.sai.msu.ru/~polar/html/publications/charge/AL147.pdf

C Sivaram and Kenath Arun "Some Additional Bounds on the Photon Charge"

http://arxiv.org/ftp/arxiv/papers/0802/0802.1562.pdf

L.B. Okun, "PHOTON: HISTORY, MASS, CHARGE", ACTA PHYSICA POLONICA B Vol. 37 (2006) http://www.actaphys.uj.edu.pl/fulltext?series=Reg&vol=37&page=565

[12] - Arminjon, M. (2006). Dirac equation from the Hamiltonian and the case with a gravitational field. *Foundations of Physics Letters, 19*(3), 225-247

Dirac at first tried to avoid the negative energy $E = -mc^2$ by supposing the unseen and infinite "sea" of particles. Instead, we now interpret the "negative energy" solutions as representative of antiparticle with positive energy[13]. So the negative part of relation (47) was used for antimatter in which was experimentally confirmed later and obtained as follows:

$$\gamma \rightarrow e^- + e^+ \qquad (48)$$

In laboratory, a gamma photon with energy E is converted to a pair of "Electron-Positron" in striking with a nucleus. In relation with pair production, there is a reverse process that is called pair annihilation in which during this process, one electron and one positron are merged with each other and electromagnetic energy comes to existence instead of it. Nowadays observation of producing and "electron-positron decay" process is an ordinary phenomenon in the laboratory. Even, proton-antiproton and neutron-antineutron pairs have been made in the laboratory[14].

Dirac ratiocinated that all states of negative energy have been occupied by electrons that they are not a part of the nature. It means that beyond the nature, there is the sea of electrons with negative energy. In addition, he deduced that with a high-energy photon, we can pull out an electron with negative energy from the sea of electrons and convert it to an ordinary electron with positive energy. Inexistence of negative energy means existence of positive energy. Therefore, the hole behaves in a way as if it is a particle with positive energy. On the other hand, inexistence of negative charge means existence of positive charge. Therefore, this charged hole has positive charge unlike electron that called positron[15].

Therefore, in CPH theory, defining the structure of photon by means of Dirac equation is in fact a physical reality that not only it satisfies about positrons but also it is an inseparable part of the nature and even we can say that weyl-fermions with spin $1/2$ are massless unlike electrons and possess a high degree of mobility; In addition, the spin (rotation) of particle is accomplished either in its side or against its side that can be concluded from it[16]. (It comes back to definition of CPH theory).

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[13] - Griffiths, D. (2008). Introduction to elementary particles: John Wiley & Sons, page 217

[14] - Luigi DiLella, "The achievements of the CERN proton – antiproton collider" http://ific.uv.es/imfp04/talks/dilella-ppbar.pdf

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, "Proton-Antiproton Pair Production in Two-Photon Collisions at LEP" http://arxiv.org/pdf/hep-ex/0306017v1.pdf

[15] - P. A. M. DIRAC, "A Theory of Electrons and Protons", Proc. R. Soc. Lond. A 1930 126, 360-365 doi: 10.1098/rspa.1930.0013

[16] - Hamish Johnston, "Weyl fermions are spotted at long last" http://physicsworld.com/cws/article/news/2015/jul/23/weyl-fermions-are-spotted-at-long-last

Review the hidden layers of Quantum Interactions

Investigation on process of "pair production and decay" in CPH theory

Consider a photon that is moving with enough energy and is converted to the "electron-positron" pair in striking with a heavy nucleus. The produced pair includes two particles one of them with positive electric charge and another one with negative electric charge. These two particles participate in two interactions with each other. One of them is gravitational interaction and another one is electric interaction. According to quantum mechanics theory, these interactions are done through exchanging of particles. Electromagnetic exchange particle is photon that carries electromagnetic force and gravitational exchange particle is graviton that carries gravitational force. Now, some essential questions is proposed:

1- How charged particles are produced from a neutral particle?

2- From what and how exchange particle (photons) is produced?

3-As we know, photon carries electromagnetic energy and includes two perpendicular electric and magnetic fields. What is the relation between electromagnetic fields of photon and electric charge of electron and positron?

4- What is the role of gravity (gravitons) in this process?

For finding the answer of these questions, it is not needed to invent complex relations that is inconsistent with physical nature of these phenomena. In addition, there is no need to invent more complicated mathematical equations and then try to impose them to the nature and investigate that which of them and under which conditions are consistent with experience.

Our guide in this field is electromagnetic waves, the method of their interaction and interaction of electromagnetic energy with gravity (gravitons).

Solving of Dirac's equation in the virtual space-time

Let's open a new window towards Dirac's Equation. Dirac's equation can be solved by using the definition of virtual photons in relation with sub quantum energies (SQEs) as follows. A real photon is formed of virtual positive and negative photons (equation 36-40). Then we have: $\gamma^+ + \gamma^- = \gamma$. This equation can be analyzed in view of CPH theory. Equation (18) can be reviewed by using the positive sub quantum energy $\rhd$ (equation 36) and negative sub quantum energy $\lhd$ (equation 37) as follows:

$$E = n\begin{bmatrix} \kappa\, G^+ & \kappa\, G^- \\ G_m^+ & G_m^- \end{bmatrix} = \begin{bmatrix} n\kappa\, G^+ & n\kappa\, G^- \\ nG_m^+ & nG_m^- \end{bmatrix}$$

Photon is electrically neutral, because the number of negative color-charges is equal to positive color-charges. It means that the sum of negative and positive color charges is zero (Electrically

summation of entries in first row of matrix is equal to zero). In other words, photon does not have any electric effect, but since it is formed of two sets of positive and negative color-charges, behaves like an electric dipole. . However, due to the very small size of photon and its high speed is barely detectable and at the far distances (relative to size of photon) is not detectable. Due to this reason, its electric effect is very weak. As the same way, magnetic effect of photon is justifiable like its electric effect. However, this very weak electrical effect of photon is considerable while reaching to an electron. Because this very weak electric charge of photon causes absorbing positive side of photon by electron due to electric dipole properties of photon and is progressed with oscillation of photon.

Now consider a high-energy photon that collides with a heavy nucleus of atom. The result of this collision is an impact to the photon. If this impact is enough amount to shatter the photon, two parts including positive and negative SQEs is separated and converted to an electron with negative charge and a positron with positive charge. So, according to equations (18, 37 and 38) we can write:

$$\begin{bmatrix} n\kappa\, G^{+} & n\kappa\, G^{-} \\ nG_m^{+} & nG_m^{-} \end{bmatrix} \rightarrow \begin{bmatrix} n\kappa\, G^{+} \\ nG_m^{+} \end{bmatrix} + \begin{bmatrix} n\kappa\, G^{+} \\ nG_m^{+} \end{bmatrix} \rightarrow (k \rhd +k \lhd) + (k_1 \rhd +k_1 \lhd) \qquad (49)$$

The right side of the equation (49) can be written as follows:

$$E = 2nP_{SQE}c \qquad (50)$$

Where P_{SQE} is linear momentum of SQE. So, we can write:

$$E = 2nP_{SQE}c = 2kP_{SQE}c + 2k_1P_{SQE}c$$

$$n = 2k + 2k_1$$

$$2kP_{SQE}c = m_{e^-}c^2 + m_{e^+}c^2$$

$$2k_1P_{SQE}c = 2\gamma_1$$

Review the hidden layers of Quantum Interactions

Where $2\gamma_1$ is energy of photon in which in this process, the photon in excess of zero rest mass is electron and positron and during the process of “electron-positron" pair is converted to kinetic energy or is absorbed by nucleus (Figure 2), that we ignore it here, so we have:

$$E = 2kP_{SQE}c = 2nm_{SQE}c^2 = m_{e^-}c^2 + m_{e^+}c^2 \qquad (51)$$

In general, we can write:

$$E = 2kE_{SQE} = k \rhd + k \lhd \rightarrow e^- + e^+ \qquad (52)$$

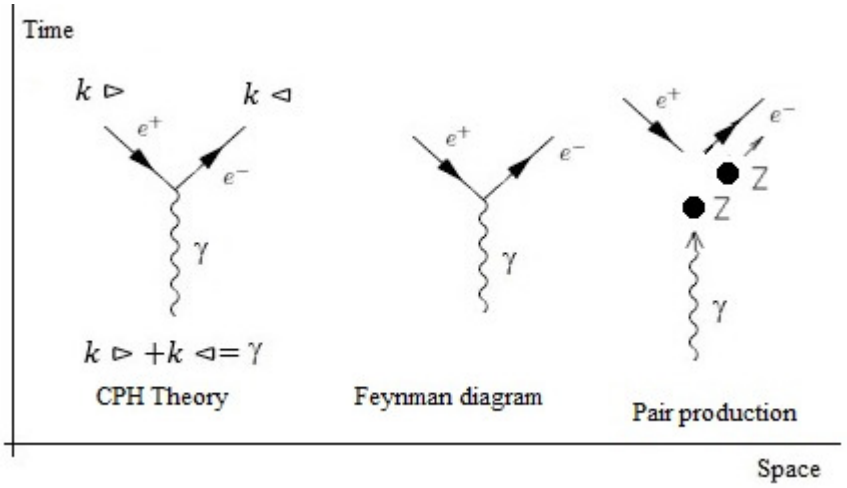

Fig2: The photon collisions with nucleus, photon disintegrates and converts to electron and positron

For pair decay and by assuming production of two photons, we can write:

$$e^- + e^+ \rightarrow k \rhd + k \lhd = 2\gamma \qquad (53)$$

Note that in the process of pair production of electron – positron, firstly the mass of photon is at least equal to the total mass of the electron and positron. Secondly, in the collision with nucleus, the photon is shattered due to caused impact of this collision.

Now suppose that a photon with the energy less than required energy of pair production of electron and positron enters into the process of collapsing, consider the following process in

equation (51) and put the number k_1 instead of the number k, so that $k_1 < k$, in this unknown process we have:

$$E = 2k_1 E_{SQE} = k_1 \rhd + k_1 \lhd \rightarrow fw^- + fw^+ \qquad (54)$$

Where fw^-, fw^+ can move at the speed of light and with zero rest mass (regard to definition in modern physics), these particles can be Weyl fermions.

On the other hand, the photon has no electric charge, but it is formed of electric and magnetic fields. These properties are acceptable when photon has been contained from two types of sub quantum energies and with various electromagnetic properties. According to this point of view in pair production and decay e^+, e^- , we can get interesting results. Before pair production, we have a photon and after pair production, we have two fermions (electron and positron) in which each of them have their own electric fields. It means that electron and positron produce virtual photons that can absorb each other. After pair decay, their electric fields are disappeared along with electron and positron. Therefore, it must be generalized the method of production and physical properties of fields from fermions to the structure of photon and vice versa. Also with such an approach, we can recognize the mechanism of electromagnetic interactions, use it to explain strong and weak interactions, and take a step towards to unify forces.

Sub Quantum electrodynamics

Consider a charged particle (e.g. an electron) that creates an electric field around itself and constantly is spreading (propagating) virtual photons. The domain of propagation of this electric field is infinity. According to well-known physical laws, there is no change in the electrical charge and mass of charged particle by emitting virtual photons that carries electric force (and it carries electrical energy too). Therefore, we have a permanent machine in which we know its production, but we do not know about its mechanism and consumable and there is no information in this case. Just it is said that there is an electric field around any charged particle. How is created this field, what is its interaction with other electrical and non-electrical fields, including gravity, nothing is said, namely, there is no explanation.

Here according to the sub quantum energies $\rhd and \lhd$, the mechanism for generating electric fields, the dynamics of attraction and repulsion between charged particles are analyzed.

Electron is a set of negative color-charges that are preserved by electromagnetic field due to its surrounding magnetic-colors. This rotational sphere (spinning electron) is adrift (floating) in a sea of gravitons and as it already was explained, gravitons are converted to positive and negative color charges in vicinity of electron. There is same explanation for positron. Electron effects on existing color-charges around itself by having two special properties. Electron has continuous spinning

Review the hidden layers of Quantum Interactions

state that can create an electric field that is formed of moving color-charges, then magnetic-colors are produced and then conditions are prepared to produce sub quantum energies. Positive color-charges are absorbed towards electron, but magnetic field around it is repellent of positive color-charges. By spinning movement of electron, a number of positive color charges are compacted and converted to positive virtual photon γ^+ and are repelled by its surrounding magnetic field. As the same way, positron absorbs negative color-charges and its surrounding magnetic field compacts negative color-charges and propagates it as negative virtual photon γ^-. Therefore, we can define an operator that expresses the process of producing positive virtual photons by electron. If we show this operator with $\lhd s$ that effects on electron and it is respect to time of γ^+, it means that it creates the carrier of positive electromagnetic force, then we have:

$$\frac{d}{dt} \lhd s(G^+) = a \rhd = \gamma^+ \qquad (55)$$

Where a is a natural number. As the same way, positron behaves like electron that is similar to a generator and it produces and propagates negative virtual photons (Figure 3) and then we have:

$$\frac{d}{dt} \rhd s(G^-) = a \lhd = \gamma^- \qquad (56)$$

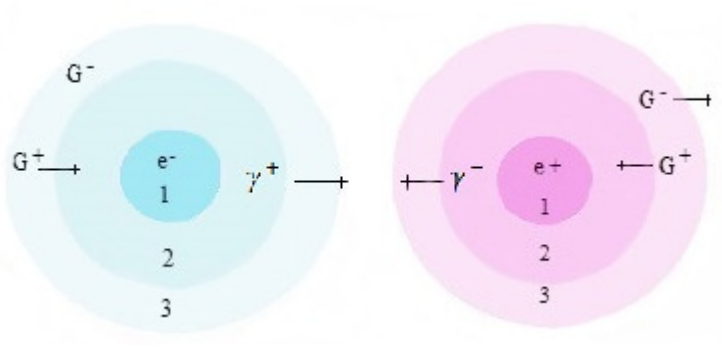

Fig3: Electron and positron are attracted each other by positive and negative virtual photons.

When $a \rhd = \gamma^+$ from the electron reaches to area 2 of positron, it combines with $a \lhd = \gamma^-$, and a real photon is created. According to Newton's second law, what happens when (at the moment) γ^+ reaches the positron?

1-Two different virtual photons γ^+, γ^- absorb each other and the effect of magnetic field gradually neutralizes on γ^-.

2- Positron and γ^+ repel each other by the force F_{1e}

3- Positron and γ^-absorb each other by the force F_{2e} (Because by reaching γ^+ to the area2 around positron, the effect of propulsion (Buoyancy) for magnetic field of positron neutralizes and cannot repulse γ^- . According to the figure (4) and Newton's second law, we have:

$$F_{1e} = \frac{E(\gamma^+)e^+}{r_1^2}, \qquad F_{2e} = \frac{E(\gamma^-)e^+}{r_2^2}$$

$$r_1 > r_2 \Rightarrow F_{2e} > F_{1e}$$

$$F_{e=}F_{2e} - F_{1e} = m_{e^+}a$$

Positron gets energy $\gamma^- + \gamma^+ = \gamma$ and accelerates by force $F_e = F_{2e} - F_{1e}$ toward the electron.

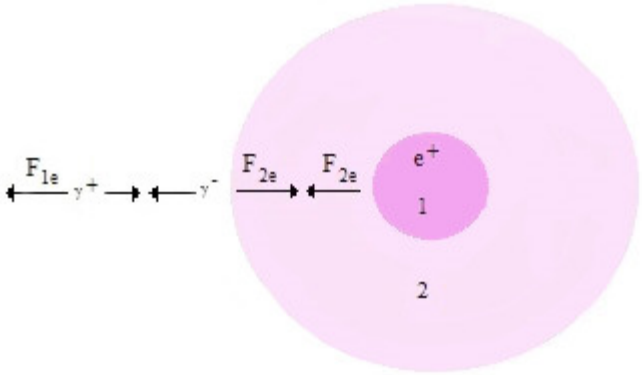

Fig4: Acceleration the electron and positron according to Newton's second law

The similar mechanism happens for electron, when $a \lhd= \gamma^-$reaches from positron to area 2 around electron, combines with $a \rhd= \gamma^+$ and creates a real photon. (Figure 5). Then, we have:

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

$$\downarrow \quad \sim\sim\sim \gamma$$

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

Fig5: Production and combination of virtual photons by electron and positron

Review the hidden layers of Quantum Interactions

Note that electrical force is almost $F_{electrcity} \cong 10^{40} F_{gravity}$ gravitational force[17], so the effect of color-charges on the virtual photon is not significant.

Electron creates positive electric field, positron creates negative electric field and they propagate these fields in the space. When charged particle was discovered, it imagined that the charged particle and the surrounding fields are the same. If we accept, the charged particle and the surrounding fields are not the same; it does not create any effect on electromagnetic theory, because two homonymous charged particles repeal each other and two non-homonymous charged particles absorb each other. Then our observations shows that existing field around electron repeals negative charged particle. Therefore, positive virtual photons are created around electron and negative virtual photons are created around positron. Now consider a positron that lies in electric field of an electron. Positron produces $\gamma^-$and at that moment γ^+ reaches to a positron. In this case, γ^- and γ^+ combine with each other and a quantum electromagnetic energy produces and is absorbed by positron. The direction of energy that is absorbed by positron is exactly towards electron and positron accelerates towards electron. A similar process happens for electron and this process is continuously iterated (Figure 3).

Here it was considered just a path, it was assumed that the positive virtual photon moves on a specified path and goes from the side of electron toward positron and combines with negative virtual photon produced by positron and accelerates to positron that is not apparently consistent with quantum mechanics. Because in classical mechanics, just a path indicates the motion of the particle, while all paths for a particle in quantum mechanics can be considered, even routes that is similar to the classic route. However, it is not true, a positive virtual photon can move on all possible routes to reach positron or not. It is important that not only electron is producing and emitting positive virtual photons continuously, but also a lot of positive virtual photons are moving in electrical field of electron, each of them has been entering to area 2 of positron, it would do the same action as described above. It is important that we understand the mechanism of this action and explain in a way that is consistent with the basic laws of physics.

For example, look at forming snowflake. Due to perching in different conditions while forming, snow crystals possess complicated shapes with many details and then due to existence of many probable states, probability of finding two snow crystals with completely similar structure is very poor. The researches of Kenneth Libbrecht[18], professor of physics at the California Institute of Technology on snow crystals in different temperatures shows complexity of its geometric shapes. These different conditions can be categorized in this way. The different number of water molecules in crystals, the difference of gravitational force imposed on the snowflakes and the forces of snowflakes around one snowflake impose on it before freezing effects on geometrical shapes of snow crystals.

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[17] - Michael's Question, "Electric Forces Versus Gravitational Forces"
http://www.batesville.k12.in.us/physics/phynet/e%26m/electrostatics/michaels_question.htm
[18] - Kenneth G. Libbrecht, "Snow Crystals" http://www.snowcrystals.com

As the same way, we do not know and we cannot observe or compute that which positive virtual photon goes forwards positron, but we know from physical laws that each positive virtual photon that approaches (comes close to) the positron, positron accelerates towards electron.

Understanding and explanation of this matter is very important for us, not large number of virtual photons and different paths probably go through. Even in Feynman diagrams, it is important that what the results of interaction between particles is, not probability of traveled and passed paths.

According to $\gamma^{+}+\gamma^{-}=\gamma$, it can be explained very well that why carrier photons of electromagnetic force are not visible. The production process of virtual photons by using sub quantum energies is explainable. This explanation is based on physical fact that a photon is formed of two sets of positive and negative color-charges in which each of them has its own dependent magnetic field. Production of virtual photons occurs like radiation of charged particles with a specific frequency. It means that any charged particle with just one turn of a spinning movement creates and emits a virtual photon. In fact, every turn in spinning movement of charged particle can be considered like oscillations that causes radiation and creates a virtual photon. Virtual photons move with linear speed c and form electric field around a charged particle. Any charged particle that lies in this field, will have interaction with existing virtual photons in this field.

Note: According to above descriptions, it is observed that the energy is generated by field, and matter is generated by energy, so we can say that in CPH theory, energy is intensive field and matter is a dense energy.

Sub Quantum Chromo dynamics

As we know in quantum mechanics, there is a strong interaction in nucleus of an atom and its range is short and less than the radius of an atom. Carrier of the strong interaction force that is called gluon[19] that is a particle with spin one (spin of photon is one, too).

Strong interaction is the factor of integration among large number of positive charged particles in nucleus of atom[20]. Therefore, it is stronger than electric repellent force among existing positive charged particles in the nucleus. For example, proton is formed of 3 quarks, two up quarks (u) with $(+\frac{2}{3})$ electric charge and a down quark (d) with $(-\frac{1}{3})$ electric charge p(udu). The subject that a down quark absorbs by up quark is justifiable with electromagnetic theory, because they have opposite electric charge. However, the subject that how two quarks gather together with

[19]- Frank Wilczek, "QCD MADE SIMPLE"
http://frankwilczek.com/Wilczek_Easy_Pieces/298_QCD_Made_Simple.pdf

[20] - http://www.britannica.com/science/nucleon

homonymous charged particles is another problem that still there is some theoretical problems[21] and intuitive justification about that in modern physics that can be consistent with experiments.

The explanation is given in modern physics is that boson (gluon) with spin one is carrier of color charge force between quarks and it is stronger than electric force. However, the reason and mechanism of strong interaction is easily explainable by using sub quantum energies.

In general state, we suppose that two electric charged particles A^+ , B^+، (both of them with positive charge), lie in a bigger distance of the radius of proton. As explained in the previous section, each positive charged particle repels positive color-charges and absorbs negative color -charges. The magnetic field around it compacts these negative color-charges and emits it as negative virtual photon in the space. When the distance between these two particles is high (more than the radius of nucleus of atom), before that emitted negative photon γ^- reaches from second particle to first particle, repelled positive color-charges by first particle have left the environment (they have got away from the charge surroundings). While in short distances, the repelled positive color-charges by a particle combines with negative color-charges around another particle and create electromagnetic energy.

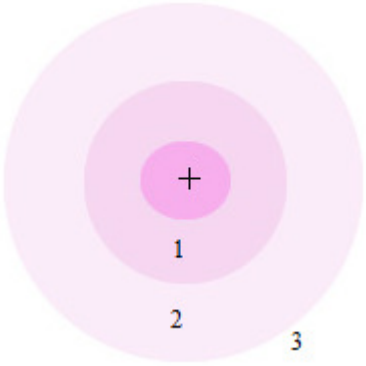

Fig6; Locations around each positive charged particle

Suppose that the particle A^+ produces a negative virtual photon γ^-in the time dt, it repels a number of positive color charges that can produce a positive virtual photon γ^+. If we consider the distance between these two particles, supposing speed of γ^- is at least equal to speed of light c, if $d > cdt$, the repelled positive color-charges by each particle is ineffective on negative color-charges around the second particle. If $d < cdt$, the mechanism of attraction and repulsion of color-charges by each particle interfere with the mechanism of the other particle, positive and

[21] - Matthew Francis, "Glueballs are the missing frontier of the Standard Model", Ars Technica, 2015
http://arstechnica.com/science/2015/10/missing-glueballs-are-sticky-problem-for-particle-physics/
K.A.Ter-Martirosyan, "Gluons in the QCD bound state problem - a way to exact solution", 2000
http://arxiv.org/abs/hep-ph/0007361

negative color-charges are converted to electromagnetic energy and these two particles absorb each other. Because if $d < cdt$, the binding energy between two particles A^+ , B^+ is stronger than repulsive electrical force between them. But if $d = cdt$, then the electrically charged particles are neural with respect to each other (figure7), which can produces vector bosons (weak nuclear interaction), so behavior of electromagnetic and weak nuclear interactions are very similar.. This process can be explained as follows:

Consider a positive charged particle that is adrift in a gravitational field. In fact, all charged particles are drift in a gravitational field. Gravitational field is made of infinite number of gravitons that are moving faster than speed of light c. Gravitons show color-charge properties in vicinity of charged particle or its magnetic field. Positive charged particle absorbs negative color-charges and repels positive color-charges. Therefore, in an area around positive charged particle is created a color-charge field and from a specific distance, positive color-charges cannot come closer to the charged particle. In figure 6 area 3, gravitational field is formed of gravitons. Gravitons are moving with linear speed $V_{GT} > c$. In area 2, they get color-charge properties. However, gravitons in any gravitational field can be converted to color-charge, but in vicinity of charged particles or electromagnetic fields are converted to color-charge with rapidly. Positive color-charges cannot enter into area 1 and are repelled, but negative color-charges enter into area 1, are compacted under the effect of magnetic field and are emitted as negative virtual photon γ^- and electric field creates.

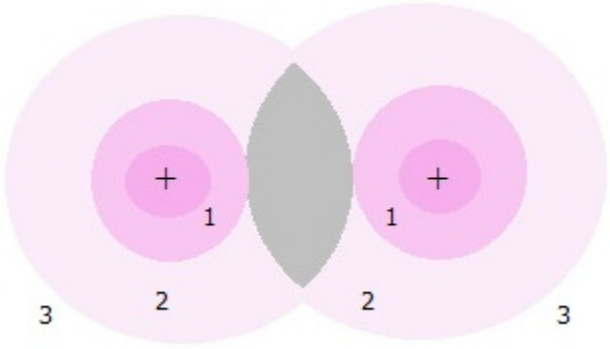

Fig7; interconnect two positive charged particles

Nuclear fusion in the center of stars is repeating this process. When two homonymous charged particles became close enough to each other , their magnetic fields are united and keep togther these homonymous charged particles like plasma of charged particles (Figure 8). In the center of the stars, due to high speed (transitive energy) of nuclues of atoms, they come close enough together and protons (in fact quarks) fall in each other color-charges areas and provide the necessary binding energy and nucleuses do fusion. There are many protons (in fact quarks) in a heavy nucleus, the number of quarks can have common color-charges area and absorb each other.

Review the hidden layers of Quantum Interactions

Paying attention to internal structure of photon is very useful and important for better understanding of QCD and QED. Mass-energy equivalence includes the concepts and applications beyond the concept of converting mass to energy and vice versa. Something that occurs from the interactions between quarks in the structure of protons is the logical result of the interaction between $\triangleright$ and $\triangleleft$ in the structure of photon. In addition, during conversion of energy into mass, properties of interactions between $\triangleright$ and $\triangleleft$ are transferred from structure of the photon to particles and anti-particles. The same process that happens for two non-homonymous charged particles (in the nucleus of atoms) in center of stars, happens for formation of the negative and positive virtual photon γ^-, γ^+ by negative and positive sub quantum energies $\triangleleft, \triangleright$ (figures 9 and 10).

Now suppose two positive charged particles A^+ and B^+ are near each other that location2 interferes with each other (figure 7). Their direction movement is the opposite of A^+ production. Therefore, in location2, positive color-charges $G^+$from A^+ and negative color charges $G^-$from B^+, have the same direction movement that is toward the B particle. They combine and convert to electromagnetic energy and transfer to the particle B^+. The same action happens for positive color-charges $G^+$from B^+ and negative color-charges G^- from A^+; so, they form quantum energy that moves toward A^+.

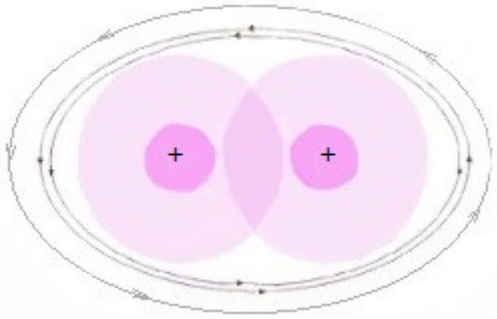

Fig8: The magnetic field around two same charged particles

Nuclear fusion in the center of stars is repeating this process. When two same charged particles were close together enough, they also have common magnetic fields and the same charged particles such as plasma charged particles, held together (Figure 8). In the center of the stars, the nucleus because of the high speed (energy transition) have closed enough together, and protons (in fact quarks) fall in each other color-charges areas, each fall and provide the necessary binding energy and nucleus do fusion. There is a many protons (in fact quarks) in a heavy nucleus, the number of quarks can have common color-charges area and absorb each other.

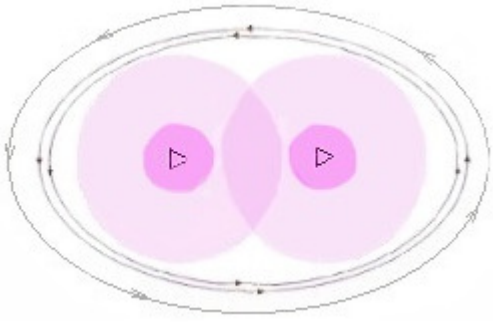

Fig9: Magnetic field around two same *SQEs*.

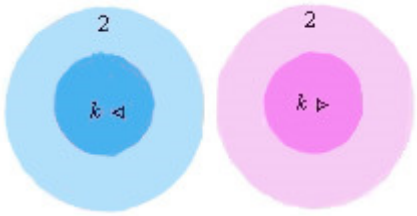

Fig10: A photon is formed of $\rhd +k \lhd$, but magnetic fields around $\rhd$ (s) and $\lhd$ (s) prevent them from this combination

In standard model of particle physics, any particle has its ant-particle (In fact, matter and antimatter are identical). However, standard model cannot answer to this question that why in our universe the amount of matter is more than anti matter. In other words, around us, there exist lots of matter, but antimatter does not observe. However, in CPH theory, the symmetry between positive and negative color-charges is important, not the number of equality between the number of particles and anti-particles. For example, we consider some physical processes.

Color charges Equality: Pair production and decay of electron–positron: According to equations (17 and 18), the number of positive color-charges and magnetic-colors in positive sub quantum energy $\rhd$ is equal to the number of negative color-charges and magnetic-colors in negative sub quantum energy $\lhd$. On the other hand, according to equation $E = mc^2$, mass and energy are equivalent and different experiment have shown that mass is convertible to energy and vice versa. As in the pair production and decay was shown, when energy is formed of color-charges and magnetic-colors, matters and anti matters are formed of color-charges and magnetic colors and continuously in any physical process , it must be observed the equality and balance between the number of color-charges and magnetic–colors before and after the physical process. Therefore, if before the process, the number of positive and negative sub quantum energies are equal with each other and if after the process, the number of positive and negative sub quantum energies are equal with each other, it is enough. According to the subject that matter is formed of negative color-charges and antimatter is formed of positive color charges, it holds the equality between matter

and antimatter from the physical laws in the nature. It means that it is possible the nucleus has negative-electric charge in other universe and fields include particles with positive electric charge.

Just it is important that the law of conservation of color – charge not to be violated that it completely holds.

Example 1: Pair production and decay:

$$E = k(\triangleright + \triangleleft) \rightarrow e^+ + e^- = (e^+ = k \triangleright) + (e^- = k \triangleleft)$$

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

$$e^+ + e^- \rightarrow 3\gamma = 3\left(\frac{k}{3} \triangleright + \frac{k}{3} \triangleleft\right) = k(\triangleright + \triangleleft)$$

Example 2: Proton and antiproton: This is a useful step to explain the real processes of photon and actual processes in quantum chromo dynamics QCD[22].

$$p\bar{p} \rightarrow \gamma + \gamma$$

The positron and proton have equal electric charge of $+1$, antiproton and electron have also equal charge of -1. Independent of their masses about color-charges symmetry we have:

$$k \triangleright = e^+, \qquad k \triangleleft = e^-$$

$$u = \frac{2}{3} k \triangleright, \qquad d = \frac{1}{3} k \triangleleft$$

$$\bar{u} = \frac{2}{3} k \triangleleft, \qquad \bar{d} = \frac{1}{3} k \triangleright$$

[22] - Freund A., "Exclusive annihilation p pbar to gamma gamma in a generalized parton picture" arXiv: 0208061v1, hep-ph, 2002

$$p\bar{p} = (uud)(\bar{u}\bar{u}\bar{d}) \rightarrow \gamma + \gamma = \left(\frac{2}{3}k \rhd + \frac{2}{3}k \rhd + \frac{1}{3}k \lhd\right) + \left(\frac{2}{3}k \lhd + \frac{2}{3}k \lhd + \frac{1}{3}k \rhd\right) \Rightarrow$$

$$= \left(\frac{5}{3}k \rhd + \frac{5}{3}k \lhd\right) = n(\rhd + \lhd)$$

Therefore, there is color-charges symmetry in the output of process. Also nuclear force that continuously keeps protons and neutrons in the nucleus of atom, it is not a fundamental force in fact, but it is a force that is obtained from quark colors force.

Unification of forces has paid attention from long years ago and it is a top research now too. Finally, physicists succeeded to show that in very high energies, they have succeed to unify electromagnetic and weak interactions, and it is possible to happen between weak and strong interactions in higher energy too. According to the above mentioned, it is necessary to pay attention to the two essential points:

1- Except one case that force and Newton's second law was used to explain the gravitational force (absorption) between electrons and positrons, force was not applied to explain phenomena and just investigated about particles and their interaction to explain them. In all interactions, the transfer of energy and momentum was discussed .Therefore, essentially in physics, force is an invented expression to simplify computations of interaction between particles (and bodies), it has no entity outside the mathematical calculations and just there exists transfer of energy and momentum between objects and particles.

2 - According to the principle of gravitons and the fact that all particles, energy and fields are created by gravitons, basically, there is no acceleration in its classical concept. In the classic concept of acceleration that is defined by Newton's second law as F = ma, the force (which is the external factor applied on an object or particle) is a factor to change velocity. It means that the velocity of an object (particle) can be increased or decreased. Therefore, in CPH theory, acceleration has a sub-quantum concept that is different of its classic (even relativistic) concept.

At the beginning of the 20th century, Newton’s second law was corrected by considering the limit speed c and the relativistic mass and infinite mass was substituted instead of infinite speed. It means that it was accepted in relativity that force can increase speed, with a difference in which in relativity, mass increases along with increasing the speed.

In this written text tried to show the necessities to investigate about relativistic Newton's second law with different deductions and investigation about some of physical phenomena. Nowadays in some published physical researches, it has been proposed many problems and unsolved questions that will remind with no answer without considering the internal structure of structural particles. Moreover, the current definition of energy cannot explain the interaction between particles in high energies. The correct understanding about the structure of photon enables us to find out the

structure of matter. By considering the structure of photon and by using the new definition of graviton, electric charge and charged particles, our point of view will change about the nature. In addition, this approach will provide us a new instrument to come over physical problems and conduct physics in a better path. Moreover, by reconsidering the relativistic Newton's second law, it can be explained the expansion of the universe better and more real than the past.

4

Review hidden layers of Newton's law and cosmology equations

Since Newton introduced his universal gravitational law, although this law is described in celestial mechanics was a dazzling success, but was also associated with some questions and ambiguities. Newton found by the law of gravity, stars shall attract each other and thus do not seem to be at rest. In 1692, Newton wrote in a letter to Richard Bentley[1]: "As to your first query, it seems to me that if the matter of our sun and planets and all the matter in the universe were evenly scattered throughout all the heavens, and every particle had an innate gravity toward all the rest, and the whole space throughout which this matter was scattered was but finite, the matter on the outside of the space would, by its gravity, tend toward all the matter on the inside, and consequently, it falls down into the middle of the whole space and there compose one great spherical mass. But if the matter was evenly disposed throughout an infinite space, it could never convene into one mass; but some of it would convene into one mass and some into another, so as to make an infinite number of great masses, scattered at great distances from one to another throughout all that infinite space.[2] "

The next problem is that according to Newton's gravity law a body could attracts unlimited other objects and it grows to infinity, this is also unrealistic, because it is not compatible with experience. In addition, Newton second law which show the mass variations (i.e., the infinite speed in classical mechanics is replaced by the infinite mass). Infinite mass is not observable (such as infinite velocity), how can we explain the limit of speed without infinite mass? In generally, how we can resolve infinity problems of physics? The theme of this section is removing infinities of physics.

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[1] - Richard Bentley (1662 - 1742) an English classical scholar, critic, and theologian.

[2] - Joseph Joubert, Pensdes, "The Newton-Bentley Exchange"
https://ned.ipac.caltech.edu/level5/Sept02/Saslaw/Saslaw1_2.html

Reconsidering the relativistic Newton's second law

In Newtonian mechanics, the time is absolute, and infinite speed was accepted and Newton's second law with constant mass that was presented as follows:

$$F = \frac{dp}{dt} = m\frac{dv}{dt} \qquad (57)$$

By proposing of the relativity and limit speed of light c, the equation (57) was corrected so that the limitation of speed must had applied. So the Newton's second law was as follows:

$$F = \frac{dp}{dt} = \frac{d(mv)}{dt} = v\frac{dm}{dt} + m\frac{dv}{dt} \qquad (58)$$

Bucherer by measuring the ration of charge with respect to mass of electron e/m in different speed, showed that mass increases along with increasing the speed[1]. Bucherer experiment was an experimental verification of relativistic mass and due to accuracy of relativistic Newton's second law (Equation 58). Increasing the mass of electron while passing from accelerator tunnel (imposing external force) is due to obtaining energy and energy has mass. The subject that an object (or a particle) cannot move with speed of light, is due to structure of matter and mechanism of interaction of field with matter that by principle of graviton and sub quantum energy, being constant of the value of speed can be generalized from energy to mass. Therefore, it is worthy to reconsider Bucherer experiment. In Bucherer experiment, consider an electron with mass m_0, speed v_1 and at moment t_1 is moving on direction of an axis, accelerates under effect of force F and at the moment t_2, its speed is v. In time interval $\Delta t = t_2 - t_1$, electron gains energy equal to E , and its mass increases as $m_E = nm_{SQE}$ (equation 26). So, we can write:

At moment t_1, speed and momentum of electron is v_1 and m_0v_1 respectively.

At moment t_2: speed and momentum of electron is v and mv respectively.

So that:

$$m = m_0 + m_E\,, m_E = nm_{SQE} \Rightarrow m = m_0 + nm_{SQE} \qquad (59)$$

[1] - Thos. Lewis, "The Interpretation of the Results of Bucherer's Experiments on e/m"
Proceedings of the Royal Society of London. Series A, Containing Papers of a Mathematical and Physical Character Vol. 107, No. 743 (Mar. 2, 1925), pp. 544-560

According to the conservation law of linear momentum, the momentum of input electron $m_0 v_1$ plus momentum of energy gained in interval time $\Delta t = t_2 - t_1$, must be equal to output momentum. Therefore, we have:

$$m_0 v_1 + n m_{SQE} c = mv$$

But according to equation (59), $m = m_0 + n m_{SQE}$ and by replacing, we have:

$$m_0 v_1 + n m_{SQE} c = (m_0 + n m_{SQE}) v$$

$$v = \frac{m_0 v_1 + n m_{SQE} c}{m_0 + n m_{SQE}} < c \qquad (60)$$

Because v_1 is the speed of input electron at t_1 and all laboratory experiments show that the speed of the electron is less than the speed of light c, also, if the electron speed was greater than the speed of light, there was no need to relativity. So, according to $v_1 < c$, we have:

$$v_1 < c \ \therefore \ v = \frac{m_0 v_1 + n m_{SQE} c}{m_0 + n m_{SQE}} < \frac{m_0 c + n m_{SQE} c}{m_0 + n m_{SQE}} = c \Rightarrow v < c$$

In Newton's second law, the extra mass can be related to gained energy. So, we have:

$$\frac{dm}{dt} = \frac{n m_{SQE}}{dt} = \frac{1}{c^2}\frac{dE}{dt}$$

$$F = \pm \frac{v}{c^2}\frac{dE}{dt} + m\frac{dv}{dt} \qquad (61)$$

The ± sign in equation (61) has been marked for two states of the increasing and decreasing energy (collinear or non-collinear directional variations in force and speed). The Newton's second law in equation (61) increases our ability to have better cognition and explanation of physical phenomena. With such an approach to physical and astrophysical events, the explanation of

universe will be more real. According to the principle of sub quantum energy SQE, the value of speed of formed particles is continuously constant in subatomic particles and external force just can convert the motion of SQEs from linear motion to nonlinear motion and vice versa.

The speed of created particles is a function of internal interaction, mechanism of creating sub atomic particles and external forces imposed on them. Thus, the speed of light is constant in vacuum, but it changes in other environments such as air or water and as soon as entered into vacuum, it moves with the same constant speed.

In addition, speed of other subatomic particles is a function of internal reactions between particles (interaction between SQEs in the structure of particles). In fact, in Boucherer experiment, electron gains energy while accelerating and after exiting from accelerator tunnel loses its energy due to striking with other particle or passing throgh a field that gives it a negative acceleration and comebacks to the earlier state regarding the mass.

This experiment can be used continuously to verify relativity, but it cannot be explained real interaction between force and mass with relativistic mass. The reason for limitation of speed must be investigated in the structure of matter. Moreover, the relativistic attitude is a post structural view and explains observer's point of view and it has not paid attention to the inherent nature of phenomena. While in this written text tried to investigate about physical phenomena regarding the internal structure of particles and explain the necessity of reconsidering in relativistic Newton's second law.

In fact, the external force cannot change the value of speed under any physical conditions and it just can convert linear motion of formed particles of matter and energy to nonlinear motion and vice versa. With such insight, we can have better cognition from singularity by definition of absolute black hole, explain before big bang and express the reason of inflation.

Singularity, Newton's second law contrasts with the law of universal gravitation

Assume that the observable universe would collapse due to gravity, is there any force that can counteract the gravity collapse in the universe? In other word, after the universe collapses, how and by which law (or force) will the universe expand again? A gravitational singularity or space-time singularity is a location where the quantities that are used to measure the gravitational field become infinite in a way that does not depend on the coordinate system[1]. These quantities are the scalar invariant curvatures of space-time, which includes a measure of the density of matter. For the purposes of proving the Penrose–Hawking singularity theorems[2], a space-time with a singularity is defined to be one that contains geodesics that cannot be extended in a smooth manner. The end of such a geodesic is considered to be the singularity. This is a different definition, useful

[1] - Jos´e M. M. Senovilla, "Singularity Theorems in General Relativity: Achievements and Open Questions." arXiv:physics/0605007v1, 2006

[2] - The Physics of the Uuniverse, http://www.physicsoftheuniverse.com/scientists_hawking.html

for proving theorems. Singularities can also be divided according to whether they are covered by an event horizon or not (naked singularities). According to general relativity, the initial state of the universe, at the beginning of the Big Bang, was a singularity. Both general relativity and quantum mechanics break down in describing the Big Bang.

Despite its successes, the standard big bang theory was too simple to be complete. The Theory proposes a period of extremely rapid (exponential) expansion of the universe during its first few moments. Cosmologists introduced this idea in 1981 to solve several important in cosmology[3]. It was developed to explain several puzzles with the standard Big Bang theory, in which the universe expands relatively gradually throughout its history[4]. The question is, if the universe collapses, will it reach to infinite density and zero volume? Or is there a force that will counteract it? In the following, according to reconsidering relativistic Newton's second law, the answer to Big Bang is explained and regarding the sub quantum energy, the Friedmann's equation is reviewed[5].

Cosmological Equations

To derive his 1917 cosmological model, Einstein made three assumptions that lay outside the scope of his equations[6].

1- The universe is homogeneous and isotropic in the large (i.e., the same everywhere on average at any instant in time).

2- The total volume of a three-dimensional space with uniform positive curvature would be finite but possess no edges or boundaries (to be consistent with the first assumption).

3- The universe as a whole is static - i.e., its large-scale properties do not vary with time.

When Einstein first studied the universe at large using the General Theory of Relativity he discovered that his equations predicted a universe which was either expanding or contracting and this was contradicted with the best astronomical observations at the time. He then modified his equations to satisfy the observations. This modification corresponds to the assumption that the whole universe is permeated with a constant pressure (which in his case balanced the expansion yielding a steady universe). This universal pressure is called the cosmological constant Λ (lambda).

Einstein's static universe is closed and contains uniform dust and a positive cosmological constant with value $\Lambda_E = 4\pi G\rho/c^2$, where G is gravitational constant, ρ is the energy density of

[3] - The inflationary Universe, http://www.ctc.cam.ac.uk/outreach/origins/inflation_zero.php

[3-] Kane, G, "Tthe dawn of physics beyond the standard model", Scientific American, vol 288(6), p.68-75, 2003

[5] - Aleksandr Aleksandrovich Friedman (1888 – 1925)

[6] - The Cosmological Constant, http://abyss.uoregon.edu/~js/glossary/cosmological_constant.html

the matter in the universe and c is the speed of light[7]. The radius of curvature of space of the Einstein universe is equal to:

$$R_E = \frac{c}{\sqrt{4\pi G\rho}} \qquad (62)$$

The cosmological constant appears in Einstein's field equation in the form of:

$$\boldsymbol{R_{\mu v}} - \frac{\mathbf{1}}{\mathbf{2}}\boldsymbol{g_{\mu v}R} + \Lambda \boldsymbol{g_{\mu v}} = \frac{\boldsymbol{8\pi G}}{\boldsymbol{c^4}}\boldsymbol{T_{\mu v}} \qquad (63)$$

Where $\boldsymbol{R_{\mu v}}$ is the Ricci[8] curvature tensor, R is the scalar curvature, $\boldsymbol{g_{\mu v}}$ is the metric tensor, Λ is the cosmological constant, G is Newton's gravitational constant, c is the speed of light in vacuum, and $\boldsymbol{T_{\mu v}}$ is the stress–energy tensor.

At almost exactly the same time, Friedmann carefully revised the Einstein's cosmological equations and he published his classic relativistic cosmology. His key realization was that isotropic world models had to have isotropic curvature everywhere. In the paper of 1922, Friedmann found the solutions for expanding the universe models with closed spatial geometries, including those that expand to a maximum radius and then collapse to a singularity. Friedmann showed that there exist expanding solutions that are unbounded with hyperbolic geometry[9]. The differential equations[10] that he derived were:

$$\left[\left(\frac{1}{R}\frac{dR}{dt}\right)^2 - \frac{8}{3}\pi G\rho\right]R^2 = -kc^2 \qquad (64)$$

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[7] - Domingos Soares, Einstein's static universe, 2012, http://arxiv.org/pdf/1203.4513.pdf; Cosmology , http://www.astronomy.ohio-state.edu/~dhw/A873/notes3.pdf

[8] - Gregorio Ricci-Curbastro (1853 – 1925) an Italian mathematician

[9] - MALCOLM S. LONGAIR, "A Brief History of Cosmology", Carnegie Observatories Astrophysics Series, Vol.2 Measuring and Modeling the Universe, 2004, ed. W. L. Freedman (Cambridge: Cambridge Univ. Press) http://www.astro.caltech.edu/~george/ay21/readings/longair.pdf

[10] - The Friedmann Equation, https://ned.ipac.caltech.edu/level5/Peacock/Peacock3_2.html http://hyperphysics.phy-astr.gsu.edu/hbase/astro/fried.html

After Hubble discoveries on the universe's expansion, Friedmann's equation was as follows:

$$\left(H^2 - \frac{8}{3}\pi G\rho\right)R^2 = -kc^2 \qquad (65)$$

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

In other words, Friedmann raised the possibility of a dynamic universe, which changes in size over time. In fact, Friedmann introduced the expression "expanding universe." Moreover, one of his solutions modeled a cosmos which began in a singularity – an infinitesimally small point. It even had an expansion rate which increased over time, just as modern observations indicate. Einstein wrote a short note in the German Physics Journal, Zeitschrift fur Physik, calling Friedmann's non-stationary world "suspicious." Friedmann immediately sent the great physicist an extended letter detailing his work. Six months later, Einstein wrote in the journal:". . . my criticism . . . was based on an error in my calculations. I consider that Mr. Friedmann's results are correct and shed new light."[11]

In the 1990s, experimental observations showed that the expansion of the universe is accelerating and dark energy is tending to accelerate the expansion of the universe[12].

The Big Bang theory is an effort to explain what happened at the very beginning of our universe. According to the standard Big Bang theory, our universe sprang into existence as "singularity" around 13.7 billion years ago. What is a ''singularity'' and where does it come from? Well, to be honest, we don't know for sure. Singularities are zones which defy our current understanding of physics. They are thought to exist at the core of ''black holes.'' Black holes are areas of intense gravitational pressure. The pressure is thought to be so intense that finite matter is actually squished into infinite density (a mathematical concept which truly boggles the mind). These zones of infinite density are called ''singularities.'' Our universe is thought to have begun as an infinitesimally small, infinitely hot, infinitely dense, something - a singularity. Where did it come from? We don't know. Why did it appear? We don't know[13].

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[11] - Mark Egdall, "Alexander Friedmann: Unsung Hero of Modern Cosmology", 2012, http://www.decodedscience.org/alexander-friedmann-unsung-hero-of-modern-cosmology/19423

[12] - ADAM G. A RIESS, et, at., "OBSERVATIONAL EVIDENCE FROM SUPERNOVAE FOR AN ACCELERATING UNIVERSE AND A COSMOLOGICAL CONSTANT", THE ASTRONOMICAL JOURNAL, 116:1009È1038, 1998 September

[13] - All about science, Big Bang Theory - An Overview, http://www.big-bang-theory.com/

Review hidden layers of Newton's law and cosmology equations

With several issues being raised in the late twentieth century, modern physics was challenged and while quantum mechanics and relativity did not have the ability to respond and resolve issues also they cannot do it todays. Despite such problems, physicists are trying to find an appropriate and convincing response only on the scope of quantum physics and relativity and in this respect need to pay attention to the classical mechanics. Series of failures exist in some categories of these theories, that prior to their use, they should be clarified and resolved. In CPH theory, regarding on review of Newton's second law, we have been attempted to enter to the sub-quantum space by crossing the border of quantum mechanics then to survey of counteracting Newton's second law and the universal gravitation law and finally we can be analyzed and investigated the results. In sub-quantum space, we passed across the black hole and reach the formation of the absolute black hole by specifying the limits of Newton's second law and gravitation law, then the singularity will be explained in the explosion of an absolute black hole. In this review we will be forced to change their attitude towards the singularity and the general conclusion in the singularity state is: ***volume will not be zero, density will be limited.***

In this part of the review of singularity, a new definition of singularity provided. But regardless of escape velocity on black hole, we cannot review singularity. If the kinetic energy of an object launched from the Earth were equal in magnitude to the potential energy, then in the absence of friction resistance it could escape from the Earth. Escape velocity is the minimum speed needed for an object to "break free" from the gravitational attraction of a massive body. The escape velocity from Earth is about 11.2 km/s. For a spherically symmetric massive body such as a star or planet, the escape velocity v_{esc} for that body, at a given distance is calculated by the formula:

$$\mathrm{v}_{esc} = \sqrt{\frac{2GM}{R}} \qquad (66)$$

Where G is the universal gravitational constant, M is the mass of the planet or star, and R is radius of star. If the mass of the star was compressed to such a small size or high density that the magnitude of the escape velocity v_{esc} was greater than the speed of light c, $\mathrm{v}_{esc} > \mathrm{c}$, then nothing even light could escape the gravitational pull. A black hole has a gravitational field is so strong than not even light can escape its pull[14]. As when a stone is thrown upward to a certain height goes up, the question is, light (a radiation) from the surface of a black hole to how high can go up? The answer is that it depends on the height of the scape velocity at which the black hole. In absolute black hole, intensity of the gravitational field is so large that even light cannot shake from its place at the top. This is just a simple and intuitive definition of an absolute black hole, but we should define an absolute black hole by using the scientific concepts and cosmological equations and

[14] - Ron Kurtus, "Gravitational Escape Velocity from a Black Hole", The School for Champions, 2011, http://www.school-for-champions.com/science/gravitation_escape_velocity_black_hole.htm#.VxJAOvl97IU

analyzing its results. According to equations (49 and 50), energy is formed of sub quantum energy, bearing in mind the equation (26) $E = np_{SQE}c$ and considering the properties of SQEs, we can define the absolute black hole. Here, it is necessary to focus on relations (29 and 30 that have given before)[15]. According to equations (29, 30) the amount speed V_{SQE} is constant, but the amounts of transmission speed V_{SQET} and non-transmission speed V_{SQES} are not constant, by decreasing the amount transmission speed of SQE is added to the amount non transmission speed and vice versa. Each of these values is maximum when another value is zero that is given by:

$$V_{SQET} \to V_{SQE} \Leftrightarrow V_{SQES} \to o \qquad (67)$$

$$V_{SQES} \to V_{SQE} \Leftrightarrow V_{SQET} \to o \qquad (68)$$

Thus, according to the direction of external force which was affected on a particle/object, the total non-transmission speeds rate is converted to the transmission speeds or to the inverse.

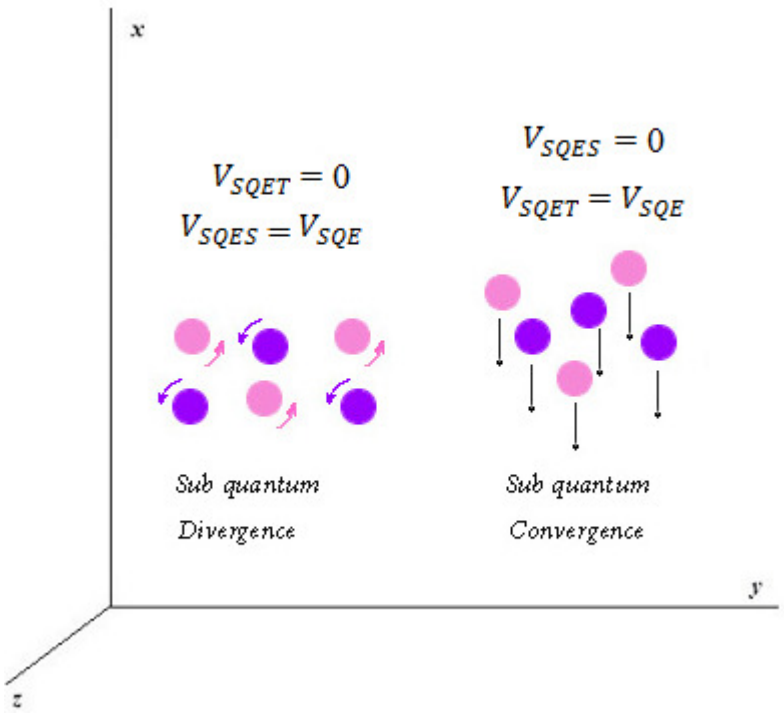

Fig11; Sub-quantum Divergence and Convergence

[15] - $\nabla V_{SQE} = o$, in all inertial reference frames and any space (29)

$|V_{SQE}| = |V_{SQET}| + |V_{SQES}| = constant$ (30)

Now we can define an absolute black hole. But before explanations, it is necessary to define two terms of sub quantum divergence and sub quantum converges;

1- Sub quantum Divergence: if a particle/object falls in the gravitational toward a massive body, and the linear speed of its $SQEs$ will be V_{SQET} , we say that the object has sub quantum divergence (Figure 11). There is $V_{SQE} = V_{SQET}$ in the sub quantum divergence. So;

$$\text{Sub quantum Divergence; } V_{SQET} = V_{SQE} \Leftrightarrow V_{SQES} = o \qquad (69)$$

2- Sub quantum Convergence: if total transmission speeds $SQEs$ of a particle/object go to zero, $V_{SQET} \to 0$, we say that the object has sub quantum convergence (Figure 11). There is $V_{SQES} \to V_{SQE}$ in the sub quantum convergence. So;

$$\text{Sub quantum Convergence: } V_{SQES} \to V_{SQE} \Leftrightarrow V_{SQET} \to o \qquad (70)$$

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

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

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

1) Its constituent $SQEs$ reach sub quantum convergence state i.e. $V_{SQES} \to V_{SQE}$. So the linear speed of everything on the surface of absolute black hole goes to zero, $V_{SQET} \to 0$

2) Due to the gravitational pressure, the average distance between $SQEs$ of an absolute black hole goes to zero.

Once the non-transmission speed of $SQEs$ reach maximum, $V_{SQES} \to V_{SQE}$, the average distance between $SQEs$ goes to zero due to intensive collision.

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

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

Now, by using the equations (69 and 70), the Friedmann's equation (64) and then the Big Bang will be reviewed.

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

Right side of the Friedman equation, has given for real space-time and is used for after the Big Bang, because k determined the geometrical properties of space-time and c is the speed of light in a vacuum is constant, but given that the speed of light is not constant in gravitational field (equation 5) and it is zero for surface and inside of an absolute black hole (equations 42 and 43), So if we want to solve the Friedmann's equation for absolute black hole, we must consider the speed of light to zero and the equation becomes as follows:

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

Assuming $R \neq o$ (which is a reasonable assumption because the notion that, if the universe collapses, it will not vanish volume and it is not reasonable that universe was created of nothing), then we have:

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

We take the square root of the above equation, so we have:

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

Review hidden layers of Newton's law and cosmology equations

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

We take an integral from both sides of above equation:

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

$$R = e^{\pm\sqrt{\frac{8}{3}\pi G\rho}\, t + C} = e^{C} e^{\pm\sqrt{\frac{8}{3}\pi G\rho}\, t} \qquad (71)$$

For $t = 0$ the initial radius of the universe is obtained (at the moment of the Big Bang), we have;

$$R_o = e^{C}$$

For the negative mode, we have:

$$R = R_0 e^{-\sqrt{\frac{8}{3}\pi G\rho}\, t} = \frac{R_0}{e^{\sqrt{\frac{8}{3}\pi G\rho}\, t}} \qquad (72)$$

Equation (72) means that the radius of the universe is shrinking over time and is not acceptable. For positive mode, we have:

$$R = R_0 e^{\sqrt{\frac{8}{3}\pi G\rho}\, t} \qquad (73)$$

Equation (73) is an exponential function that shows in the first moments after the explosion, expansion of the universe was very fast. In addition, because of the big bang, Newton's second law contrasts with the law of gravitational law, in this confrontation, Newton's second law, and the universal gravitational law is neutralized. In the early moments after the Big Bang the speed limit was not the speed of light *c*, because $SQEs$ collide with each other, everything, even the photons

were decomposed and the speed limit could have one of two values SQE speed V_{SQE} or the speed of graviton V_G . So, we can write:

$$\left[\left(\frac{1}{R}\frac{dR}{dt}\right)^2 - \frac{8}{3}\pi G\rho\right]R^2 = -kV_{SQE}^2 \qquad (74)$$

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

Perhaps still in the aftershocks of the Big Bang to take over the universe. In addition, there is no proof for the existence, be limited to the observable universe, or owes its existence not earlier collapse.

5

Review hidden layers of Entropy and Space Time

Thermodynamics is a branch of physics which deals with the energy and work of a system. Thermodynamics deals only with the large scale response of a system which we can observe and measure in experiments. Small scale gas interactions are described by the kinetic theory of gases.

Quantum thermodynamics is the study of the relations between two independent physical theories: thermodynamics and quantum mechanics. The two independent theories address the physical phenomena of light and matter.

But "there are some aspects of thermodynamics that are irreconcilable with quantum mechanics, namely irreversible processes for systems left to themselves do occur in nature but they are not in quantum mechanics. Reproducing the second law of thermodynamics from quantum statistical mechanics is still a difficult challenge from theoretical point of view, and it has not been accomplished yet[1]." On the other hand, according to the sub quantum energy, the redefined energy seems need to reconsider the thermodynamics laws.

Thermal Energy and the Sub Quantum Energy

In defining the sub quantum energy, we saw that energy and matter are made of sub quantum energy, and the difference between matter and energy depends to their transmission speed. Also, the total amount of transitional and non-transitional speed of sub quantum energy is constant (equation 30). So, in CPH theory, energy is same as matter with high speed. In the other word, energy moves with transmission speed of light c, and matter moves with transmission speed of v, that $v < c$. So, speed of heat is c, too, because it is a kind of energy. The amount transmission

[1] - Quora, "Do the laws of thermodynamics apply at the quantum level?", https://www.quora.com/Do-the-laws-of-thermodynamics-apply-at-the-quantum-level

speed of matter v is changeable between zero and c, $0 \leq v \leq c$ relative to inertia frame, when v become to c ($v = c$), the matter is converted to energy. It can be shown that the temperature T of the system (such as gas) is a function of transmission speed of SQEs of system.

Let's assume that a system including k different molecules. In heating the system, the kinetic energy of the molecules increases. In this process, SQEs belong to heat and molecules of system are sharing their momentum and transmission speed of molecules increase (reconsidering the relativistic Newton's second law equation 61). Molecules absorb SQEs of heat, the mass[1] and transmission speed of molecules increase, as thermodynamic interpretation, temperature T of the system increases.

Why does material emit energy?

Thermal energy emitted by matter as a result of vibrational and rotational movements of molecules, atoms and electrons. The energy is transported by electromagnetic waves (photons). Radiation requires no medium for its propagation; therefore, it can also take place in vacuum. All matters emit radiation as long as they have a finite (greater than absolute zero) temperature[2]. A system such as gas is made of molecules or atoms, and atoms are not at static state in system. They are moving or oscillating around each other. Also, atoms are made of charge particles, and they absorb or repel each other. So, they are working on each other continuously. In a system charge particles work on each other and according to above section they emit electromagnetic energy. So, every system emits heat energy, and intensity of radiation is depending on its temperature. During the day, the earth is heated by the sun and at night, heat escapes from earth into space. The most important fusion process in nature is the one that powers stars. In the 20th century, it was realized that the energy released from nuclear fusion reactions accounted for the longevity of the sun and other stars as a source of heat and light. Pressure due to gravity is balanced by pressure of the ionized gas in the star which behaves like an ideal gas. Radiation leaving from the surface determines the luminosity of the star. A star like our sun has enough hydrogen to fuel the fusion of hydrogen to helium for some 10 billion years during which the sun shines stably. So system does negative work on itself by converting matter to energy.

Inherent Power of a System

As each system emits radiation continuously, we can define a work function for every system dependent on the temperature as $W=W(T)$. The higher temperature of system, the more negative work will be done on itself. As a result of this negative work, the system emits heat and its temperature continuously is reduced. The negative work of a system on itself is named the inherent

[1] - Tony Rothman, "Was Einstein the First to Invent $E = m2^2$?" 2015, http://www.scientificamerican.com/article/was-einstein-the-first-to-invent-e-mc2/

[2] - Radiation; https://www.eng.fsu.edu/~shih/eml3015/lecture%20notes/radiation.htm

system power and it is shown with P. Inherent power of system on itself is always negative (such as radiation and loses thermal energy), but related to the environment it is positive. This means that each system emits heat radiation to environment, even if the system is colder than the environment. It is better to define inherent power of system relative to environment that is positive to help to explain the thermodynamic of the system easier. Relative to the environment view, each system has a positive power P > 0 that is defined as follows:

$$P = \frac{dW(T)}{dt} = kE_{SQE}$$

Where $P > 0$ is inherent power of system and k is a natural number that indicates how many SQE leave the system per time. According to equation (61) system loses energy dE/dt and the kinetic energy of molecules is reduced. Inherent power of system is referred to transfer heat from the system to the environment. Real systems are not isolated and they exchange $SQEs$ with other systems and also the inherent power of a real systems never reaches to zero.

Suppose k_1 is the number of SQE leave system and k_2 enter to system, $k = k_1 - k_2$ is the result of the heat exchange between system and environment. And if $k > 0$, the inherent power of system is reduced and it cools, such as the pan is removed from the oven. If $k < 0$, the inherent power of system is increasing like a stone under the sun light. Whenever $k = 0$, two systems are in thermal equilibrium. If P_1 be the primary inherent power of system and P_2 secondary, for an isolated system always: $P_1 > P_2$, and its radiation is decreasing. There is no real isolation system in nature, because the universe itself has radiation which is called the cosmic microwave background radiation. In every direction, there is a very low energy and very uniform radiation that we see filling the Universe. This is called the $2{,}725°K$ Background Radiation, or the Cosmic Background Radiation.

Thermodynamic Basic-level State of a System and *SQE*

As already explained, every system has an inherent power that is greater than zero $P > 0$. If a system loses its inherent power, it is at basic-level state of thermodynamics. In the other words, a system would be at basic-level state of thermodynamics, if its inherent power goes to zero $P = 0$ (figure 12).

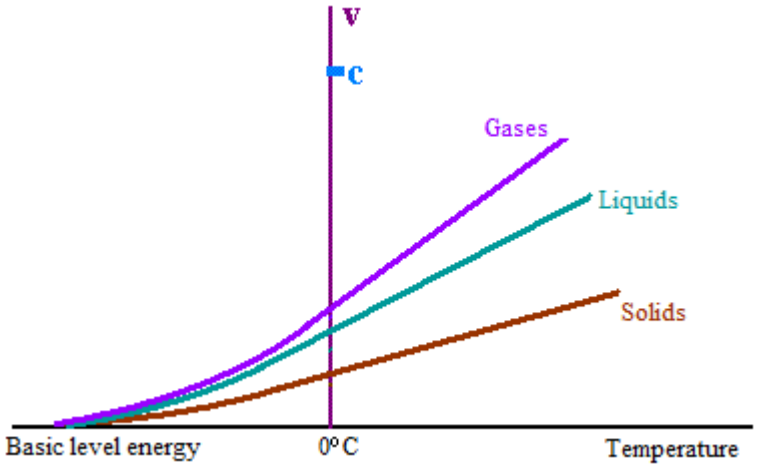

Fig 12; speed and temperature of a systems

When a system is at basic-level of thermodynamics, its charged particles are not able to work on each other, so the system does not emit heat energy. When a system is at basic-level of thermodynamics, then its temperature is absolute zero. Suppose a system is at basic-level of thermodynamics, it contains n of *SQE*s that are moving with velocity $v_1 = 0$ in system. We give heat to it, in fact k of *SQE*s with speed c enter the system, and particles of system absorb them. In a real environment the inherent power of a system cannot be zero, even in space, because there is cosmic background radiation in space. A real system never reaches to basic-level of thermodynamics, because no system in the universe can be absolutely isolated.

First Law of Sub Quantum Thermodynamics

A system works on the environment with inherent power $P > 0$. To stabilize or increase the internal energy of a system, we must give heat energy to system with power $P' \geq P$.

The Second Law of Sub Quantum Thermodynamics

There is no actual physical process by which we can make the inherent power of a system P one-way. Consider that in an actual physical process the inherent power is not constant. Because heat energy incomes and outgoes of an actual systems.

Third Law of Sub Quantum Thermodynamics

An actual physical system never approaches the basic-level of thermodynamics. There is no physical process to take a system to the thermodynamic basic-level state.

Review hidden layers of Entropy and Space Time

Sub Quantum Entropy

Entropy (ΔS) of a system is equal to its inherent power (P), $\Delta S = \mathrm{P}$, so entropy of a system approaches zero only at basic-level thermodynamics.

Physical time

Time is one of the most complex concepts that usually the human mind has been preoccupied about it. Scientists and philosophers have struggled to identify and explain the nature of time. However, still there is no definition for physical definition of time, and it is still just a scientific undefined quantity**.** "It would be nice if we could find a good definition of time." Richard Feynman said[1]. With naivety about time, time is passing from past to the future which from all eternity would last forever. This is exactly the simplified form of the absolute time of Newtonian physics. Although, the nature of time was intended, but do we really have anything for time except the clock and its ticking.

Richard Feynman once quipped, "Time is what happens when nothing else does[2]." If nothing happens, so there is nothing cause of happen, when there is nothing, what is time that could happens? So it seems what Feynman has said is a philosophy explanation (not defined) of time and it is not even physical explanation. However, Julian Barbour disagrees with Feynman and says: "if nothing happened, if nothing changed, then time would stop. For time is nothing but change. It is change that we perceive occurring all around us, not time. Put simply, time does not exist."[3] Some other authors and researchers say that time is an illusion[4]. “The meaning of time has become terribly problematic in contemporary physics, the situation is so uncomfortable that by far the best thing to do is declare oneself an agnostic.” says Simon Saunders[5].

Efforts to understand time below the Planck scale have led to an exceedingly strange juncture in physics. The problem, in brief, is that time may not exist at the most fundamental level of physical reality. If so, then what is time? In addition, why is it so obviously and tyrannically omnipresent in our own experience? [6]

In order to have better understanding of the physical nature of time, reviewing physical properties of particles can be helpful and how they interact. The question is: what is the physical

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[1] - The Feynman Lectures on Physics Vol. I Ch. 5: Time and Distance
http://www.feynmanlectures.caltech.edu/I_05.html

[2] - Julian Barbour, "The End of Time: The Next Revolution in Physics", http://www.amazon.com/The-End-Time-Revolution-Physics/dp/0195145925

[3] - Last reference. Julian Barbour,

[4] - Craig Callender, "Is Time an Illusion?", Scientific American, 2010,
[Online] available; http://www.scientificamerican.com/article/is-time-an-illusion

[5] - Folger, Tim, "Time May Not Exist" 2007, Discover, http://discovermagazine.com/2007/jun/in-no-time

[6] - Last reference, Folger,

nature of time? Moreover, which particles do not experience passing time? Are there such particles? If so, what are their features? In physics, we see only clocks, our efforts is to understand more than ticking clocks. Is there time independent of clocks? Is time describable without of clock? Usually, clock is introduced as a tool that shows passing time, behind this simple definition of time, there is something else. This ambiguity permeates to thought that not all clocks are synchronized with each other, and surprisingly they have very different lifetime. Probably human is looking for an eternal clock, a clock that works independently of all physical events and will work forever.

A commonplace definition of time

A clock is an instrument to indicate, keep, and co-ordinate time. (In fact, an instrument reveals or observes iteration of a specific event). The earth is a clock, because it continuously shows the iteration of sunset and sunrise. Heart of human being is like a clock, because its beats is an iterative event. However, certain clocks are more regular than some other clocks. In comparison, the earth is a clock more regular than heart of human being. Because by running or sickness, the rate of heart beating changes. Therefore, we cannot take into account earth and heart as two synchronous clocks, because sometimes the distance between two sunrises happens x times and sometimes with y times of heart beating. Of course, it might be said that this is not a failure or deficiency of heart beating, it is from earth that irregular with respect to heart, but we have other clocks that we can compare with it, like sand clock.

We can make a sand clock and show that it is synchronous with earth clock, but it is not synchronous with heart clock and again we make a mechanical clock and compare it with earth and heart and show that the problem is from heart clock. Therefore, some of the clocks are more regular than other clocks and most well-known regular clock is atomic clock[7].

Is there any special physical relation between clock and iterative event that indicates passing time? Because in physics, we cannot follow nonphysical communications, so this communication must be specified by investigating physical phenomena, if there exists.

Physical nature of Time

In equations and computation of classic physics, time used an absolute quantity. The subject that time is really absolute or not, did not discuss anymore and it was not considerable to draw attention of researchers and scientists. Because, there was not any physical experience that be inconsistent with being absolute of time. However, after "Michelson-Morley Experiment"[8] and

[7] - A Brief History of Atomic Clocks at NIST, http://tf.nist.gov/cesium/atomichistory.htm
[8] - Leonardo Motta, "The Michelson-Morley Experiment", http://scienceworld.wolfram.com/physics/Michelson-MorleyExperiment.html

formulation of "Lorentz Transformation"[9] and especially with appearance of relativity, synchronization of two same clocks was challenged in different speeds and more than even the physical nature of time was questioned of. However, in relativity, it has been discussed about dilation of time.

Michelson-Morley experiment was incompatible with the Galilean transformation but totally compatible with the classical principle of relativity under the Lorentz transformation. The incompatibility of the laws of electromagnetism, the classical principle of relativity, and the Galilean space-time transformation[10] led Einstein to a critical reevaluation of the concepts of space, time, and simultaneity[11]. Nevertheless, in relativity just motion of clock is noteworthy and under investigation. For example, pay attention to definition of proper time in general relativity:

A proper time is a time that an observer that moves in space-time, measures by means of his/her clock. Proper time has a high importance in general relativity, because observer can measure the effects of time dilation in different locations and various paths that goes through in space-time by using it[12]. Essentially, in relativity, it is not discussed about physical nature of time. Discussion about nature of time was proposed after philosophy in quantum mechanics.

Quantum mechanics investigates about time from both experimental and conceptual dimensions. Although paradox of twins was proposed in relativity, but quantum mechanics claims, photon does not experience passing time[13]. Photon travels in space milliards of light years and when it enters to light systems on the earth, behaves like photons in which have been created on the earth and in the lab a moment ago. Is photon stationary (static) on the axis of time? In other words, is photon moving in the space that does not experience passing time in the words of quantum mechanics, but motionless in the time? It means that here this question that, is not there a space-time to the relativistic concept for the photon? Essentially, what is the relation between space and time with a physical object (existent) for example (e.g.) a stone?

Stone interacts with other physical existents. The question is: what is the relation between stone, space and time? Is stone a physical existent in the framework of space and its position changes on the axis of time too? Suppose that this stone has occupied a part of space and while there exists in that space, it cannot be substituted by other object. This is exterior (appearance) of this event that

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[9] - Lorentz Transformation Equations,
http://ffden-2.phys.uaf.edu/212_fall2003.web.dir/Eddie_Trochim/Lorentztransform.htm

[10] - Space-Time Structure, Newton's Laws and Galilean Transformation
http://www.newagepublishers.com/samplechapter/000485.pdf

[11] - Marshall L. Burns, "MODERN PHYSICS FOR SCIENCE AND ENGINEERING" Electronic Textbook License Agreement, 2012 , pp. 11 and 36
http://web.pdx.edu/~pmoeck/lectures/Modern%20Physics%20for%20Science%20and%20Engineering%20(eval).pdf

[12] - Time measured by a clock that has the same motion as the observer. Any clock in motion relative to the observer, or in a different gravitational field, will not, according to the theory of relativity, measure proper time. The free dictionary
[Online] available; http://www.thefreedictionary.com/proper+time

[13] - - http://www.whillyard.com/science-pages/electromagnetic-force.html

we can vacate the occupied space by stone and substitute it with another object. If we throw the small stone outside the room, has been vacated the space occupied by stone? The answer is positive from the view of an observer that has sat down in the room and can substitute another thing instead of empty space of stone. It means that the empty volume in the room has increased. However, generally in fact, the stone has not egressed from the space that had occupied, but it has taken its space along with itself.

By egression stone from the room, even if a complete vacuum holds in the room, again a new space substitutes by a space in which it had already been occupied by stone from mathematical dimension (not physical). For example, vacate the water inside a glass and fill it by syrup. Have you assigned the space of water to the syrup? The answer is negative. Water took its space with itself while vacating and syrup entered into the glass along with its space. Perhaps, you can vacate the air among molecules of water, but you cannot get the space among molecules of water (the space mixed with molecules of water). Generally, mass (or energy), space, motion and time have been mixed and are inseparable from each other.

Now pay attention to motions inside the structure of stone atoms or water of glass, do you can stop their movements? You can to stop the stone relative to a system, but you cannot make motionless its elements such as electrons. Generally, mass (or energy), space, motion and time are intertwined and inseparable from each other. Changing motion properties including speed of stone relative to a system is something that appeared for us, while it is partial of inherence of formed particles of stone. We move the stone. By increasing the speed of the stone, according to relativity, swing electrons around the nucleus changes. So, there is a relation between the transmission speed of stone and rotation of the electron around the nucleus. This relation between transmission and non-transmission speed is the reason that a cesium atom at different speeds, slow or rapid fluctuations that are different evokes the time dilation. So, the motion of the constituent particles of stone and time are intertwined. Generally, the mass (or energy) with space, movement and time are intertwined and are inseparable which other that we can observe, detect or visualize a physical being. Image or visualize a physical entity in our mind is something and its physical reality is something else. If these two (phenomenon and physical reality) were unit, we did not need to research and think about the reality of a physical entity and everything was clear for us, but it is not. Our knowledge of the physical beings is the result of centuries and continuous efforts that we have reached to modern physics. There is three attitudes about time in the modern physics. One is based on relativity, other is a result of quantum mechanics progress and the third attitude of thermodynamics. In all three views, space, mass (or energy) and movement are the intrinsic properties of a physical entity, but there is considerable differences view about time.

In special relativity, moving clock works slower than static clock. What does it mean moving clock in special relativity? It means that, the clock A that is in inertial system and moves with the speed v, works slower than the time that was in the same static system. This proposition has been

proved in experience with life-span of peon and muon[14]. We can make a conclusion from this discussion that if transmission speed of clock increases, it works slower. This experience can be compared by using photons, photon moves with transmission speed equal to speed of light and according to emphasis of quantum mechanics; it does not experience passing time.

According to general relativity, the clock lies in a stronger gravitational field, is slower than a clock that works in a weaker gravitational field. The gravitational time dilation has been verified by experience[15]. Till here, we have two events that can lie the time in relation with physical conditions of a system (or object). However, we have another event that relies on experience more than it can be relied on theory and essentially its rules has experimental base and it is thermodynamics. In thermodynamics, entropy is known as arrow of time. If we consider the visible universe as an isolated system, irregularity is getting increased at the moment of big bang till now. Therefore, entropy of the universe can be used as a time arrow.

So far, we have four experimental samples about physical time, speed is associated with time in special relativity, In general relativity and time is affected by gravity, in quantum mechanics is claimed that there is not time in quantum scale[16] and it is measurable in thermodynamics of entropy with the arrow of time. Now let's see how these four physical realities can be described using the sub quantum energy SQE. However, we have another amazing quantum mechanics reality that is quantum entanglement. Entanglement occurs when a pair of particles, such as photons (or electrons), interact physically. A laser beam fired through a certain type of crystal can cause individual photons to be split into pairs of entangled photons. The photons can be separated by a large distance, hundreds of miles or even more. When observed, Photon A takes on an up-spin state. Entangled Photon B, though now far away, takes up a state relative to that of Photon A (in this case, a down-spin state)[17] . That was what made Einstein as "spooky actions at a distance" refers, since changes were occurring at a point immediately at another point[18].

How this event can be explained? This event unlike thermodynamic scale of time, happens in the viewpoint of CPH theory out of time dimension and it is something beyond of time dilation. The question is: Where is the drawback of different interpretations of physical events and inconsistency in theories with each other? Is nature mysterious or unknowable? The reality is

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[14] - Cosmic ray muons and relativistic time dilation, Preston College Cosmic Ray Group, https://teachers.web.cern.ch/teachers/archiv/hst2000/teaching/expt/muoncalc/lifecalc.htm

[15] - Edwin Cartlidge, "Gravity's effect on time confirmed", Physics World, 2010, http://physicsworld.com/cws/article/news/2010/feb/17/gravitys-effect-on-time-confirmed

[16] - Quantum Theory Proves That Time Does Not Exist, 2013, http://wokenmind.com/quantum-theory-proves-that-time-does-not-exist/17/03/2013

[17] - Karl Tate, "How Quantum Entanglement Works (Infographic)", 2013, http://www.livescience.com/28550-how-quantum-entanglement-works-infographic.html

[18] - Charles Q. Choi, "Quantum Entanglement Benefits Exist after Links Are Broken", Scientific American, 2009 http://www.scientificamerican.com/article/quantum-entanglement

Tia Ghose, "Spooky Action Is Real: Bizarre Quantum Entanglement Confirmed in New Tests", 2015 http://www.livescience.com/52811-spooky-action-is-real.html

another thing. The reality is that nature rules and physical behavior of existents has been in the form that is now too. Just our knowledge and our recognition has grown and our insight has permeated from surface to depth. For better understanding and explanation of these events and different opinions, we need to permeate more in the depth of nature and take some distance of outward (appearance) of events. It means that we need to pass from the boundary of the apparent world (speed of light) and simultaneous with passing from the boundary of the apparent world, we must leave quantum scales and analyze the processes in sub quantum scales in which relativity and quantum mechanics are not able to explain them.

Quantum mechanics and relativity work in quantum scales and high speeds near to speed of light, but they are unable to explain beyond that. The problems of modern physics is due to this reason that these theories have been stopped in the boundary between speed of light and faster than light and also in quantum scales. However, physical realities like vacuum energy and virtual photons indicated that speed of light and observable particles is not the end of physical spaces. In this written text, three physical spaces were investigated and analyzed:

1- Real space-time; everything moves with speed $v \leq c$ in real space-time. Light speed is the highest speed in the real space-time.

2- Virtual space-time; it is called sub quantum energy (SQE) too. Every particle such as virtual particle is explainable in the virtual space-time. Every virtual particle moves with speed V_{SQE}, so that $V_{SQE} > c$. Virtual particles and their physical properties is explainable in virtual space-time without using uncertainty principle.

3- Non-obvious space (NOS); everything like graviton is not directly (also indirectly) detectable in non-obvious space. But, their existence and properties can be found of their effects. Productions of this space are sub quantum energies and virtual photons.

In fact, graviton is converted to sub quantum energy and virtual photon is formed of sub quantum energies. A real photon is obtained with combination of positive and negative virtual photons in which its mechanism was already explained (equations 36-40).

Also $|V_G| > |V_{SQE}| > |c|$ (equation 28), and non-obvious space exists without passing time (equation 78). It is notable that these spaces are indivisible of each other and 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.

A look at the interplay of three spaces

Our views, ideas and physical experiences are limited to observable universe or real space-time, because our tools and we belong to real space-time and obey of its rules. That is why we cannot see or detect virtual existents. However, we can see their effects.

Review hidden layers of Entropy and Space Time

World lines of a real photon and a virtual photon in Minkowski[19] space-time is the edge of real space-time where real photon is moving in vacuum with speed c, in this edge, vacuum energy is produced and appears. Thus, in the edge of Minkowski space-time, .electromagnetics and gravity are unified with each other (equations 33 and 34). The electromagnetic radiation is blueshifted when it is falling in the gravitational field[20]. We consider a small cutting in the structure of the photon and its surroundings in vacuum and investigate its mechanism in the boundary of Minkowski space-time. In this small incision real space-time, virtual space-time and non-obvious space are involved with each other (figure 13).

Minkowski formula and SQE

Here, we concentrate on speed and momentum of real and virtual photons. Therefore, we use light-like interval that given by[21]; $c^2t^2 = r^2$ or$S^2 = 0$. World lines of NRP relative to an inertial observer in (x, y, z, t) frame (according to argument and based on physical experiments) in Minkowski space-time can be written as follows[22]:

$$Real\ spacetime;\ x^2 + y^2 + z^2 = c^2t^2 \qquad (76)$$

$$Virtual\ spacetime;\ x^2 + y^2 + z^2 = V_{SQE}^2 t^2 \qquad (77)$$

$$Non-obvious\ space:\ x^2 + y^2 + z^2 = V_G^2 t^2 \qquad (78)$$

Equation (76) shows world line of photon that lies in the border of real space-time; world line of other particles such as electron that moves with speed $\mathrm{v} < c$, is given by;

$$Particles\ worldline;\ x^2 + y^2 + z^2 = \mathrm{v}^2t^2, \mathrm{v} < c \qquad (79)$$

World line of other physical extents including virtual photon and graviton is out of real space-time. In equation (77), when $V_{SQE} = c$, virtual particles appear in real space-time in which it is indirectly detectable in the structure of photon. When $V_{SQE} < c$ it is a part of quantum particles

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[19] - John D. Norton, "Spacetime", ttp://www.pitt.edu/~jdnorton/teaching/HPS_0410/chapters/spacetime/
Nilton Penha and Bernhard Rothenstein, "Special Relativity properties from Minkowski diagrams", http://arxiv.org/ftp/physics/papers/0703/0703002.pdf

[20] - R. V. Pound, et. at. (1960). Apparent weight of photons. *Physical Review Letters 4 (7)*

[21] - http://www.lecture-notes.co.uk/susskind/special-relativity/lecture-4/space-time-separation/

[22] - J. M. CHAPPELL, et. at. (2011). Revisiting special relativity: A natural algebraic alternative to Minkowski spacetime. arXiv:1106.3748v1 [physics.class-ph] .
Bros, J. (2005). The Geometry of Relativistic Spacetime: from Euclid's Geometry to Minkowski's Spacetime. Service de Physique Th´eorique, C.E. Saclay (pp. 1-45). Gif-sur-Yvette, France: Online available, http://www.bourbaphy.fr/bros.pdf.

such as electron (equation 49). The boundary between real space-time and virtual space-time is speed of light c. In gravitational blueshift and zero point energy; virtual photons leave virtual space-time and enter into the real space-time. Also in gravitational blueshift, at first gravitons enter from non-obvious space into virtual space-time, then pass from virtual space-time and enter into real space-time.

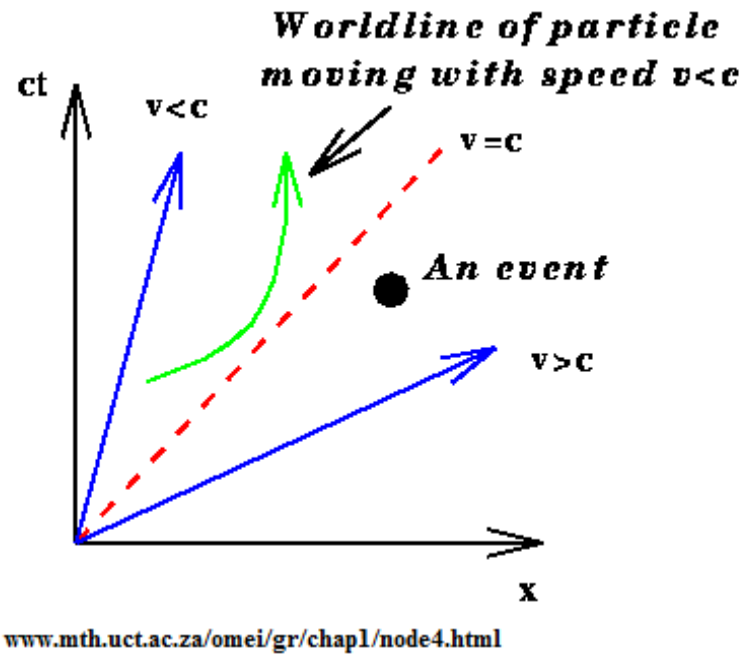

Fig13: world lines of particles in the Minkowski diagram

According to relation $|V_G| > |V_{SQE}| > |c|$, every visible (detectable) physical existent is decayed. (Here, meaning of decay is not necessarily spontaneous decay but it may be converted to other particles). Also each virtual particle is decayed, but graviton does not decay, thus it does not experience "passing time". If graviton does not experience passing time, so what does it means parameter of time t in equation (78). This equation is an assumption, for an inertial observer in real space-time. The above equation is not the only possible option and unique, the imaginary of Murkowski's formula has discussed[23]. If a graviton writes its world line equation, it may be same as ; $x^2 + y^2 + z^2 = 0$. By solving this equation in imaginary space we have;

$$x^2 = (-1)(y^2 + z^2) = i^2(y^2 + z^2)$$

[23] - Chappell, J. M., Iqbal, A., Iannella, N., & Abbott, D. (2012). Revisiting special relativity: A natural algebraic alternative to Minkowski spacetime. *PloS one, 7*(12), e51756

Review hidden layers of Entropy and Space Time

$$x = \pm i\sqrt{y^2 + z^2}$$

$$x^2 = (-1)(y^2 + z^2) = i^2(y^2 + z^2) \qquad (80)$$
$$x = \pm i\sqrt{y^2 + z^2}$$

The life of graviton is independent of time. It exists in an imaginary space and moves, so that it is not observable and detectable for human that lives in real space-time. Moreover, graviton carries information and moves so much faster than light speed. According to properties of color-charges and magnetic-colors G, G^-, G^+, G^m, graviton carries pure information in which it moves with infinite speed from the viewpoint of an inertial observer. Such an observer cannot measure the motion of graviton and transmission of its information with its clock that obeys the rules of real space-time (remember quantum entanglement[24]).

According to the above mentions and equation (76-80) with a definition, we present a general rule of objects/particles that experience or do not experience passing time and by using it we will be become closer to recognize the physical nature of time. In sub quantum thermodynamics, we saw that any physical system with inherent power $P > 0$ works on the physical environment. Now we define the physical time by using sub quantum inherent power and investigate it in equation with time in relativity and quantum mechanics.

The sub quantum definition of time: any physical being does not keep its content energy in interaction with other physical entity, experience passing time.

By this definition any physical entity that is keeping energy content, does not experience passing time, in other words, its existence is independent of time.

Quantum mechanics and time

In quantum mechanics, all particles have variable content of energy (except graviton), even photons can gain energy in interaction with other particles, like as inverse Compton scattering[25] , and the gravitational blueshift, or lose energy as Compton scattering and gravitational redshift. Therefore, energy of photon changes. Most importantly, in pair production, a photon is converted to "electron-positron" pair, in this process, photon is decayed and "electron-positron" pair are created. These are all reasons that the photon will experience passing time, but in a long journey

[24] - Horodecki, R., Horodecki, P., Horodecki, M., & Horodecki, K. (2009). Quantum entanglement. *Reviews of Modern Physics, 81*(2), 865

[25] - Inverse Compton Scattering, http://eud.gsfc.nasa.gov/Volker.Beckmann/school/download/Longair_Radiation3.pdf

in space, it moves with limit speed c, as long as it does not interact with other particles or fields, it preserves its content of energy and in this travelling , does not experience passing time. However, when photon interacts with other particles or fields, experiences passing time. Even photon while in escaping from a black hole, loses all his energy and his life ends. Thus photon that moves in real space-time with speed of light, experiences passing time, besides other quantum particles experience passing time. It means that time exists in quantum mechanics and all particles have a finite lifetime.

Relativity and time

In special relativity, moving clock works slower than stationary clock. Time dilation in special relativity must be investigated along with contraction of length. Because they are inseparable from each other. Contraction of a physical object means compactness of atoms and sub atomic particles. Whatever atoms are compacted more to each other, the inherent power of system decreases for any reason that is considered. Consider a radioactive element instead of a clock, radioactive elements in high speeds radiate less than low speed. "Radioactive decay of particles moving at high speeds has been measured to occur less frequently than radioactive decays for particles moving at lower speeds"[26].

In addition, here simultaneously two relativistic effects, expansion of time and contraction of length must be considered, reduction of volume and dilation of time have direct relation with each other. Because due to reduction of volume, inherent power of radioactive elements decreases. In addition, time dilation in general relativity happens by reduction of volume, due to gravitational pressure. The clock that is on the earth is under gravitational pressure more than a clock that lies at the top of a mountain.

Time dilation in proximity of black hole is more than surroundings of a luminary like a planet and even the time stops in the horizon of an event of a black hole (from the viewpoint of an external observer). Volume decreases due to gravitational pressure and inherent power of objects and particles reduces. From the viewpoint of an external observer, the time stops completely in a black hole. Therefore, there exists a direct relation between inherent power of system and gravitational pressure, in which it causes dilation of time in general relativity.

It must be noticed that the performance of gravitational pressure is limited. Therefore, however there exists time dilation in general and special relativity, however, it does not tend to zero for any object and particle, it means that all physical existents experience passing time in general and special relativity.

[26] - http://muller.lbl.gov/teaching/Physics10/Pages2009Spring/ReviewNote-final/Relativity_Universe.pdf

Review hidden layers of Entropy and Space Time

Thermodynamics and time

From viewpoint of sub quantum thermodynamics, any system with inherent power P works on the physical environment, so its content of energy is not constant. Therefore, from thermodynamic viewpoint all systems experience passing time. Then it is acceptable that by thermodynamic insight to the time, thermodynamic time is oriented and from the past to the future.

In thermodynamics that its study domain is large systems (relative to quantum particles), any physical existent (system) has its special location on the time axis from the past to the future. On the other hand, in thermodynamics, heat exchange of systems are studied in observable universe. The observable universe is a real space-time where it's speed is always smaller or equal than the speed of light, in such speed, always we have: $v \leq c$. The time is a real quantity and it should be used in computations in thermodynamics.

Differences between response of quantum mechanics and thermodynamics to the nature of time is referred to the difference of their expertise area. Expertise area of quantum mechanics is to recognize the nature of interactions and properties of radiations, while expertise area of thermodynamics is radiation systems and relation between them.

In quantum mechanics, some particles (such as photon) do not experience passing time, but in thermodynamics, any thermodynamic system (from a capsule of gas until observable universe), either have oriented time axis for themselves from the past to the future and the time never stops.

The sub quantum definition of clock

According to CPH theory, everything (except graviton) has an inherent power $P > o$ radiation continuously energy (electromagnetic radiation) and this process is repeated. That means in real space-time everything is a clock. If we consider the objects as a clock, the ticking of clock is radiation objects. Some objects are so irregular that we do not use them as a clock, and someone are regular clocks than others. In quantum mechanics, a photon is a unit of radiation (in terms of quantum mechanics) and does not experience passing time. When this proposition is acceptable that the energy of photon does not change and it was an unstructured particle, while it is not and energy of the photon also changes. But this attitude of quantum mechanics is a good guide for understanding the physical time. To consider the following hypothetical experience. Let's assume that a person in the laboratory is producing pair electrons - positrons by shining high-energy photons on a leaden sheet. Someone else other side of laboratory is combining the particles - antiparticles and generate new photons. Third party is out of laboratory is seeing the photons have been created by combination particles - antiparticles and he is unaware of what is happening in the lab. Until the twentieth century, human was like the third person in the above assumption. He did not know that mass is convertible to energy and vice versa, but we know.

Assume that the observable universe would collapse due to gravity. Again, a new universe appears by another big bang. We suppose a smart existent like human lives in the next universe,

the question is: How he/she will know that we have lived before him/her? All the materials in the observable universe converted to energy and energy converted to matter again. How do we know there was a universe before the present universe or it has not been existed at all? We do not know the answer of this question. However, we know that any physical existent in this universe does not destroy and just it converts to another thing, converting energy to mass and vice versa, in fact, field converts to energy, energy converts to matter-antimatter and vice versa.

The fact is that the Earth, solar system and the universe existed before us and after us will exist too. Human as a clock compares himself with older clocks, and from this comparison concludes that there exist something that is called time, and the time is independent of physical existents. While any attempt to explain or define time, independent of physical existents has been inconclusive. A physical existent with its own space and time forms its special shape and after a number of ticking, decays or converts to other physical existent.

At the lowest level of physical universe, in a small slice of space (in quantum vacuum), the three spaces, real space-time, virtual space-time and non-obvious space are intertwined and "quantum energy" is appeared. Just for non-obvious space, time does not exist, and beyond the non-obvious space, everything experiences passing time.

Is there another universes beyond the observable universe[27]? Alternatively, is the boundary of observable universe, the end of being? In this case, there are a lot of debates and discussions, but this question is such a question proposed many years ago long before the invention of the telescope, is there something beyond the solar system? At the beginning of the twentieth century, we did not know what there is beyond the Milky Way. Can we nowadays see beyond the observable universe? However, there is a thinkable question, all the stars are radiating electromagnetic energy or photons that emit to all around, so what happens for these photons that reach to boundary of visible universe? Is it absorbed before they reach to the border? If so, what does it attract them? It seems that there is nothing, which absorbs all photons in the observable universe. Is there a dam or barrier in boundary of universe to prevent their leaving? If so, what is it? In addition, there is no reason that no radiation reaches to our universe from the outside. We cannot show or prove except the visible universe, there is another universe or not! Maybe we should wait to develop technology in the future, so that we can analyze outside of the visible universe.

Coefficient of entropy-lifespan

According to relation (76-80) and thermodynamic inherent power $P > o$, it can be defined the entropy-lifetime coefficient for all physical existents from sub quantum particles to the largest physical systems as follows:

[27] - Josh Clark, "Do parallel universes really exist?" HowStuffWorks, http://science.howstuffworks.com/science-vs-myth/everyday-myths/parallel-universe.htm

Review hidden layers of Entropy and Space Time

$$C(\Delta S, t) = \frac{m}{M} \qquad (81)$$

Where $C(\Delta S, t)$ is the entropy-lifetime coefficient and dimensionless, ΔS is entropy, t is the quantity of time, M is the mass of particle or system and or any physical existent and m is the mass of radiation due to thermodynamic inherent power $P > 0$. Moreover M must be stable (invariant). If $m = 0$ then the above two conditions holds for graviton, because M is a constant and m is equal to zero and it does not experience passing time. But as far as experience shows us , other particles and physical systems is violated one of following conditions for graviton , because or m is not zero , or M is not stable. Moreover, since graviton is a base and formed of structure of energy and matter and does not experience passing time. Therefore, universe (obvious and non-obvious universe) does not have any beginning and any ending, it means that from the altitude of time, the universe has no pre-existence and no eternity and they are coinciding (matching) on each other. In more clear expression, we can imagine for universe "no pre-existence and no eternity ".

The entropy of fermions in the obvious world is zero, because their rest mass (in special relativity) is zero so that under normal circumstances their life-span is infinity. Lifetime of photons in the space is also infinite, because their entropy in the space is zero. However, while they are escaping from a gravitational field, their life-span will be decreased due to the gravitational redshift.

As well as, the entropy of a system is spreading of information. A star radiates due to its inherent power in which leads us to notice its existence and physical features. The information related to a star can be revealed through the photons, which it emits. Therefore, we can reveal and understand for a photon both its existence and properties when either we directly observe it by a real photon or we can reveal it through a virtual photon which is emitted by an electron. These revelations are related to the obvious universe, but the information related to the existence and properties of fundamental particles are also propagated by gravitons with speed faster than light speed. As we know, the elements $V_G, V_{G^+}, V_{G^-}, G_m^+, G_m^- > c$ are not observable for us. Therefore, quantum entanglement is explainable in a non-obvious space. An important conclusion from this discussion will be as follows:

In an obvious universe, physical time does not exist, independent of matter (energy). Whenever “time” is involved, one clock is associated, because human has also a physical existence and consequently he/she is a clock, too. On the other hand, a physical existence (able to being obvious) is made in its own space, and the moment that it is created, its time starts. Therefore, man is a clock, too and when we talk about the nature of time, apart from comparing the rhythm of the movement of the clocks, nothing else is explainable in physics.

To learn more about CPH theory, please refer to the following resources:

1- H. Javadi and F. Forouzbakhsh, Interactions Between Real and Virtual Spacetimes,

Fundamental Journals International Journal of Fundamental Physical Sciences, 2014

http://fundamentaljournals.org/ijfps/downloads/75_IJFPS_Dec_2014_114_121.pdf

2- Javadi, H., et. al., “Discoveries and the necessity of Reconsidering the Perspectives on Newton's Second Law”, Journal of Nuclear and Particle Physics, vol. 2(3), p.31-35, 2012

3- Javadi, H., et. al., “Definition of Singularity due to Newton's Second Law Counteracting Gravity”, Scientific Journal of Pure and Applied Sciences, Vol 2, No 3 (2013), pp. 116-124

4- Javadi, H., et. al., “Sub quantum space and interactions properties from photon structure to fermions and bosons” Scientific Journal of Pure and Applied Sciences, Vol 2, No 5 (2013), pp. 235-245

5- H. Javadi, F. Forouzbakhsh, (2007), “Zero point Energy and Dirac Equation, SQE or Tiny Energy or Minute electromagnetic Energy”, the general science journal, [Online] available:http://www.gsjournal.net/Science-Journals/Essays/View/950

6- Javadi, H., et. al., "Unification and CPH Theory", the general science journal, 2007, [online available]: http://gsjournal.net/Science-Journals/Essays/View/948

7- Javadi, H., et. al., 2007, Unification and CPH Theory, the general science journal, online available: http://gsjournal.net/Science-Journals/Essays/View/948

8- http://gsjournal.net/Science-Journals-Papers/Author/67/Hossein,%20Javadi