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Description gravity interact with space-time at the quantum level

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Abstract:

Gravity is a common source of interaction between everything in nature, even in space that is formulated as spacetime. If we want describe the gravity interact with space-time at the quantum level, we should use quantum concept of gravity that is called graviton¹.

Our believing about the existence or non-existence of gravitons do not matter. It is important that we be able to describe the gravitational interaction between particles and energy distribution in spacetime by using graviton concept. If we can do this description, so the gravitons exist and work well.

At present, the greatest problem in theoretical physics is combining the general relativity with quantum mechanics. Physicists are trying to solve this problem in the context of Standard model of particles.

In Standard Model, particles of matter transfer discrete amounts of energy by exchanging bosons with each other. This approach works in quantum electrodynamics well by define the discrete amounts of energy by exchanging virtual photons between charged particles such as electron and positron. Due this reason, a fundamental force is just binding energy between fermions such as quarks. This binding energy is electromagnetic energy that is called photon. In quantum mechanics, tiny packages of electromagnetic energy called photons and the force carrier for the electromagnetic force (even when static via virtual photons).

¹ - This is my answer to question: How does gravity interact with space-time at the quantum level?

https://www.quora.com/How-does-gravity-interact-with-space-time-at-the-quantum-level?_nsrc_=4

Description gravity interact with space-time at the quantum level

In quantum mechanics, [the graviton is a hypothetical elementary](#) particle that mediates the force of gravitation in the framework of quantum field theory. If it exists, the graviton must be massless and must have a spin of 2. This is because the source of gravitation is the stress-energy tensor, a second-rank tensor. This definition of graviton is not able to describe gravitational phenomena, so we need a new definition of graviton.

Renormalization

Renormalization is a collection of techniques in quantum field theory that are used to treat infinities arising in calculated quantities that was first developed in quantum electrodynamics (QED) to make sense of infinite integrals in perturbation theory. [The integrals for a particle of spin J](#) in D dimensions is given by:

$$I_{loop} \sim \int p^{4J-8} d^D p \quad (54)$$

For; $4J + D - 8 < 0$, the integral behaves fine for infinite momentum

For photon; $D = 4$, spin $J = 1$, and electron-electron scattering, integrals are renormalizable.

For graviton, $D=4$, $J=2$, so $4J + D - 8=4$, integrals are not renormalizable.

[String theory has solved this problem](#) with other approach on the problem.

Properties of graviton

To redefine graviton, we should consider that gravitational potential energy (is made up of discrete amounts of energy that is called graviton) is convertible to electromagnetic energy (photons) and vice versa. When a photon is falling in the gravitational field, it goes from a low layer to a higher layer density of gravitons.

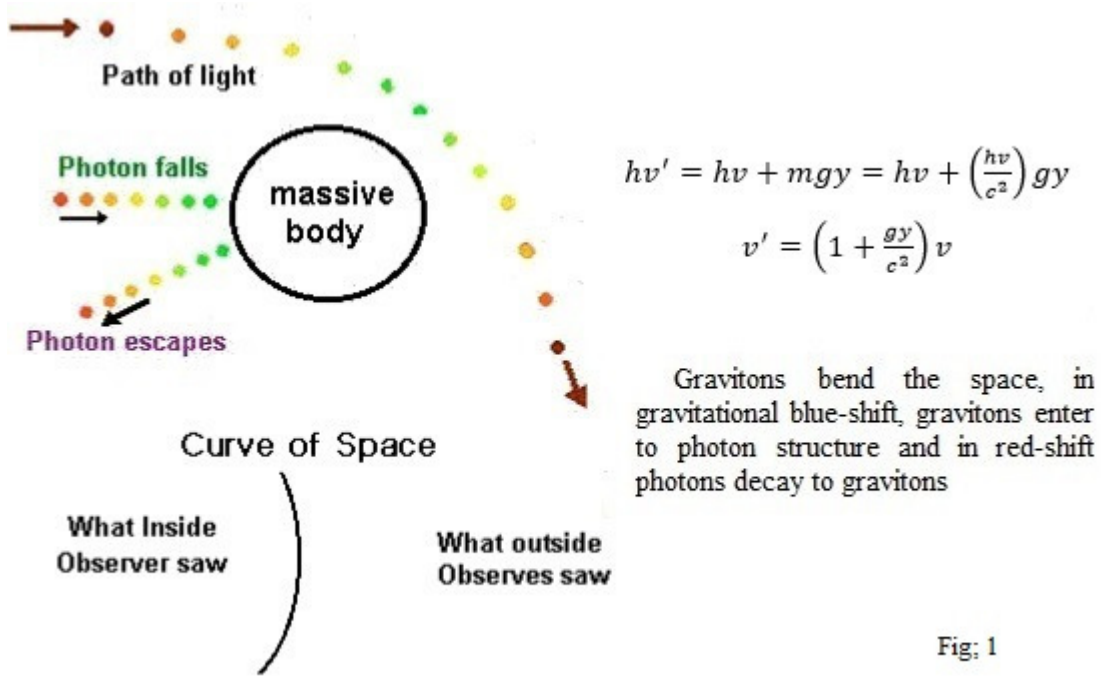
In recent decades, [the structure of photon](#) is discussed and physicists are [studying the photon structure](#). Some evidence shows the photon consists of a [positive and a negative charges](#). In addition, new experiment shows that the probability of absorption at each moment depends on the [photon's shape](#), also photons are some 4 meters long which is incompatible with unstructured concept.

Color-charges and magnetic-color

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

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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.



Gravitons bend space, the curvature of space is dependent to the intensity graviton

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. So [CPH matrix](#) is defined as follows:

$$CPH = \begin{bmatrix} \kappa G^+ & \kappa G^- \\ G_m^+ & G_m^- \end{bmatrix} \quad (4)$$

G^+ is positive color charge?

G^- is negative color-charges

Right rotation color-magnetic G_m^+

Left rotation color-magnetic G_m^-

CPH matrix shows the least magnitude energy of a photon.

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Sub-Quantum Energy (SQE)

We use CPH matrix to define positive and negative sub quantum energies as follow: The first column of CPH matrix is defined positive sub quantum energy and the second column of CPH matrix is defined negative sub quantum energy, so;

$$\begin{aligned} \text{Positive Sub Quantum Energy: } SQE^+ &= \begin{bmatrix} \kappa G^+ \\ G_m^+ \end{bmatrix} \\ \text{Negative Sub Quantum Energy: } SQE^- &= \begin{bmatrix} \kappa G^- \\ G_m^- \end{bmatrix} \end{aligned} \quad (5)$$

Positive and negative sub quantum energies are shown as follow:

Positive Sub Quantum Energy; $SQE^+ : \triangleright$

Negative Sub Quantum Energy; $SQE^- : \triangleleft$

The amount of speed and energy of positive and negative sub quantum energies are equal, and the difference between them are only in the sign of their [color-charges and magnetic-color flow direction](#).

Virtual photons

There are two types of virtual photons, positive and negative virtual photons which are defined as follows:

$$\begin{aligned} \text{Positive virtual photon; } k \triangleright &= \gamma^+ \\ \text{Negative virtual photon; } k \triangleleft &= \gamma^- \end{aligned} \quad (6)$$

Where k is a natural number

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

$$\begin{aligned} \gamma^+ + \gamma^- &= \gamma \\ (n \triangleright + n \triangleleft) &= n(\triangleright + \triangleleft) \text{ or } n|\triangleright\rangle + n|\triangleleft\rangle = \gamma \end{aligned} \quad (7)$$

$$\gamma^+ = k \triangleright, \gamma^- = k \triangleleft \rightarrow \gamma = \gamma^+ + \gamma^-$$

Where, n, k are natural numbers. So far, the production of electromagnetic energy (photons) was described by using gravitational blue-shift, 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

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other and become gravitons. In addition, there is a relation between the number of SQEs in structure of photon and energy (also frequency) of photon.

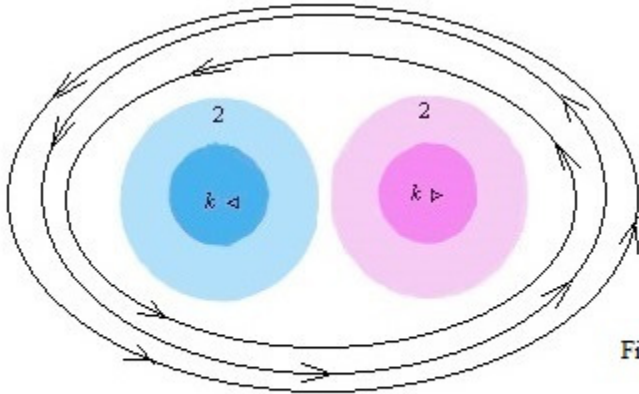


Fig: 3

A photon is formed of $k \rightarrow + k \leftarrow$, but magnetic fields around $k \rightarrow$ and $k \leftarrow$ prevent them from this combination

A photon is formed of two sets of negative and positive SQEs, but magnetic fields around them prevent them from this combination.

So, 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](#).

$$\begin{aligned} \text{Gravitational energy} &\Leftrightarrow \text{Electromagnetic energy} \\ \text{Electromagnetic energy} &\Leftrightarrow \text{particle} - \text{antiparticle} \end{aligned} \quad (10)$$

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.

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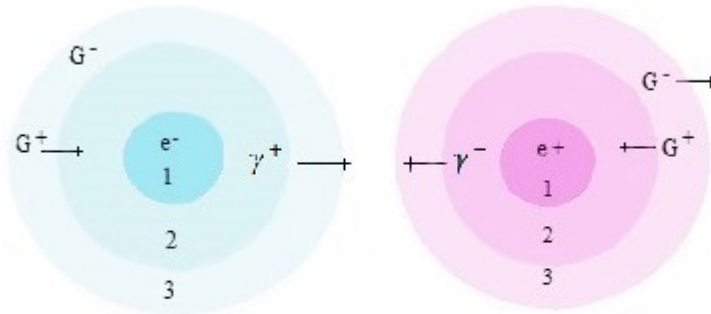
Here according to the negative and positive sub quantum energies, the mechanism for generating electric fields, the dynamics of attraction and repulsion between charged particles are analyzed.

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 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 as follow 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:

$$\frac{d}{dt} \triangleleft s(G^+) = a \triangleright = \gamma^+ \quad (11)$$

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) and then we have:

$$\frac{d}{dt} \triangleright s(G^-) = a \triangleleft = \gamma^- \quad (12)$$



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

Fig: 4

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

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When $\gamma (+)$ from the electron reaches to area 2 of positron, it combines with $\gamma (-)$ a real photon is created and positron accelerates toward the electron. The similar mechanism happens for electron.

Now we should describe the gravitational field and gravitational potential energy that are related to energy distribution in spacetime.

Is gravitational field continuous or discrete?

[Stars are born](#) within the clouds of dust. A star is made up of atoms, each atom contains a few sub atomic particles, and each element has its own gravitational field. So, the gravitational field of a star is formed of combination the gravitational fields of its sub atomic particles. When a star explodes, every part of it such as sub atomic particles carries its own gravitational field.

It shows sub atomics particles absorb each other, even in star. In the other word, gravitational field is quantized.

Gravitational field

In classical mechanic, the gravitational field g around a point mass M is a vector field consisting at every point (with distance r of point mass M) of a vector pointing directly towards the particle that is given by:

$$g = \frac{GM}{r^2}$$

G is the gravitational constant (51)

$$g_{m_{lightes}} = \frac{Gm_{lightes}}{r^2}$$

The gravitational field g around the lightest point mass $m_{lightes}$

With regard to the exchange particles concept in the quantum Field theory and the existence of graviton, when a particle / object is falling in the gravitational field, it goes from a low layer to a higher layer density of gravitons. Thus, we should investigate the impact of changing the density of gravitons on the exchange gravitons between the particles that in continue will be done.

General relativity

General relativity is the geometric theory of gravitation and the current description of gravitation in modern physics.

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In general relativity, the universe has three dimensions of space and one of time and putting them together we get four dimensional spacetime, which gravity as an emergent effect from the spacetime curvature associated with distributions of energy. [As Einstein put it](#): "**matter tells space how to bend; space tells matter how to move**".

Einstein field equation

[The Einstein field equations](#) is the set of 10 equations that describe the fundamental interaction of gravitation as a result of spacetime being curved by mass and energy.

These equations are used to study phenomena such as [gravitational waves](#).

The Einstein field equations (EFE) may be written in the form:

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R + g_{\mu\nu}\Lambda = \frac{8\pi G}{c^4}T_{\mu\nu} \quad (52)$$

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

Considerable notes about Einstein field equation

[Ricci curvature is the mathematical object](#) that controls the growth rate of the volume of metric balls in a manifold.

[Scalar curvature](#) of a Riemannian manifold is given by the trace of the Ricci curvature tensor.

[Metric tensor](#), g_{ij} is a function which tells how to compute the distance between any two points in a given space. Its components can be viewed as multiplication factors which must be placed in front of the differential displacements dx_i in a generalized Pythagorean Theorem:

$$ds^2 = g_{11} dx_1^2 + g_{12} dx_1 dx_2 + g_{22} dx_2^2 + \dots \quad (53)$$

Cosmological constant is the value of the energy density of the vacuum of space.

Stress-energy tensor in local coordinates, the stress-energy tensor may be regarded as a 4x4 matrix T_{ab} at each point of spacetime.

The Einstein field equations are not a dynamical equations that describe how matter and energy change the geometry of spacetime, this curved geometry being interpreted as the gravitational field of the matter source. Einstein tried to propound geometrical structures of space by mathematical equations. So, he used non-Euclidian geometry. There are three considerable notes on Einstein's equations;

1- Einstein Field Equations do not come from the equivalence principle directly. These equations are simply equations that are suitable for general relativity.

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2- There is a physical explanation for the path of light in a gravitational field. Although explaining the frames of reference is a physical concept, there is not any explanation of how gravitational field affects photons in general relativity. Then how can we explain this phenomenon by quantum mechanics?

3- Spacetime is a continuous quantity in general relativity. But as has mentioned before, gravitational field is quantized and the changing of photon frequency and production of energy are quantized. That gravitational blueshift (or redshift) is a special case of gravitational field that affects the photon. My question is therefore: how can we explain the gravitational blueshift according to the relationship between photon energy and its frequency?

We can describe the mechanisms of zero-point energy production that is energy distribution in spacetime.

When the density of graviton increases in space, a number of gravitons with the NR-particle 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, as follow;

$$\nabla \times \mathbf{G}_E = -\frac{\partial \mathbf{G}}{\partial t} \Leftrightarrow i(\mathbf{G}^+, \mathbf{G}^-) \quad (8)$$

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

$$\nabla \times \mathbf{B}_G = \mu_0 \epsilon_0 \frac{\partial \mathbf{E}_G}{\partial t} \Leftrightarrow j(\mathbf{G}_m^+, \mathbf{G}_m^-) \quad (9)$$

Where i, j are natural numbers. 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:

$$\begin{aligned} \text{Gravitational energy} &\Leftrightarrow \text{Electromagnetic energy} \\ \text{Electromagnetic energy} &\Leftrightarrow \text{particle} - \text{antiparticle} \end{aligned} \quad (10)$$

In Einstein's day, the strong and weak forces had not yet been discovered, but he found the existence of even two distinct forces, gravity and electromagnetism, deeply troubling. Why does everything with mass have a gravitational field?

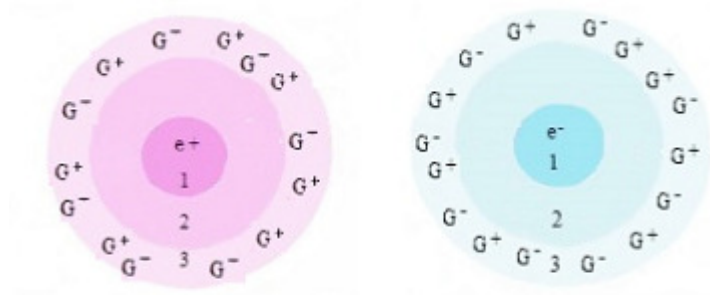
Exchange graviton between particles

In spite of publishing many articles about graviton, but it has not been done any considerable work about mechanism of graviton exchange between bodies/particles. The reason is that the old

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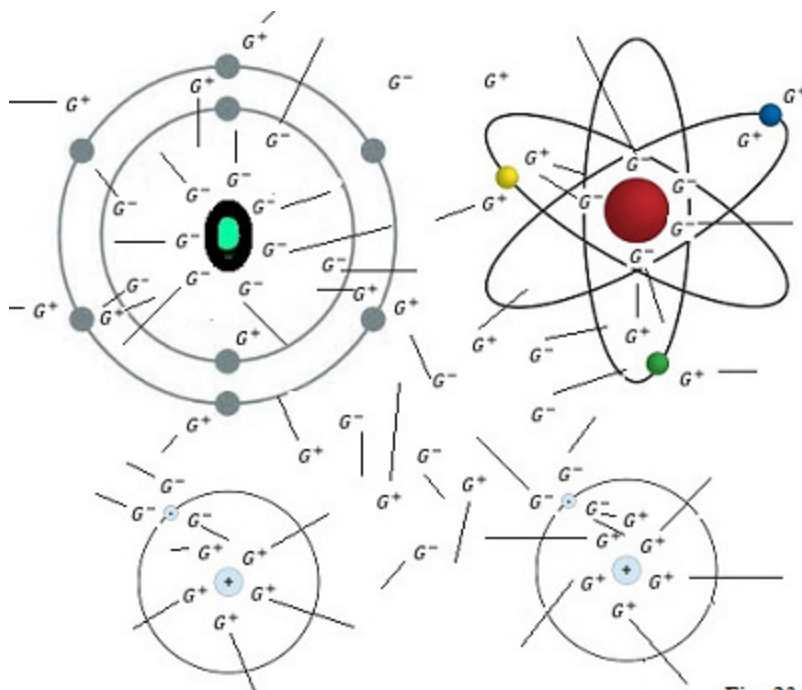
graviton definition (in modern physics) is unable to describe this mechanism and also it is impossible to get the theory of the quantum gravity .

Regard to creation virtual photons, every charged particles produce positive and negative color-charges.



Fig; 22

Positive and negative color-charges are produced surrounding the charged particles in area (3)



Fig; 23

Each atom has a gravitational binding energy with the surrounding atoms and it is related with the space by releasing color-charges.

Hence, a lot number of negative color-charges are moving outwards in the area (3) around the negative charged particles. And a lot number of positive color-charges are moving outwards in the area (3) around the positive charged particles (see figure).

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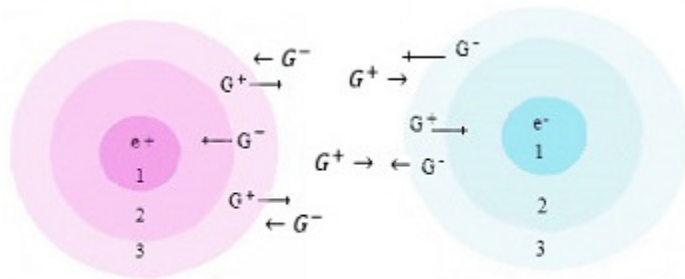


Fig: 24
Around the charged particles in area (3)

According to above figure, a lot number of positive color-charges move from the positive charged particle toward the negative charged particles, and negative color-charges move from negative charged particle toward the positive charged particle and they combine in each other (in area 3) and produce the sub quantum energies, then gravity energy is produced and these two particles accelerate toward each other.

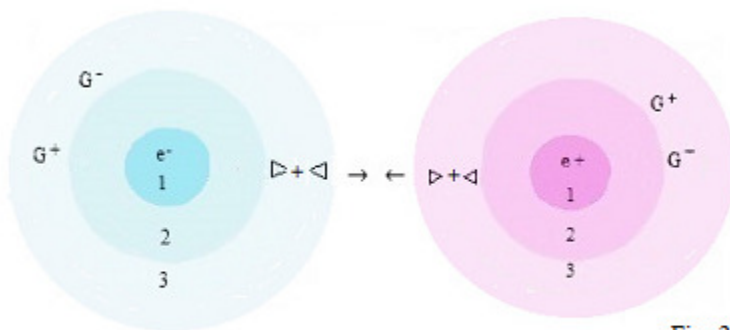


Fig: 25
Gravitational energy is produced in area (3) and two particles are accelerated toward each other

Although the mechanism of gravitational energy generation of two identical sign charged particles is similar with two different sign charged particles, but the method of generation of and sub quantum energies is different. In order to explain the generation process of gravitational energy between two identical sign charged particles, it is necessary to explain the process of the generated electromagnetic energy by the interaction of their electrical repulsion.

According to CPH Theory, gravity is a currency among the objects. Consider the interaction between the earth and the moon: when a graviton reaches the earth, the other one moves toward the moon and pushes the earth toward the moon. Because as to maintain equality times - positive and negative color-charges, there is a fixed ratio between the mass and the number of gravitons surrounding. Also when a graviton reaches the moon, the other one moves toward the earth and pushes the moon toward the earth. So earth (In fact everything) is bombarded by gravitons continuously. Due to the fact that everything is made up of sub quantum energy, the classical concept of acceleration and relativistic Newton's second law needs to be reviewed.

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Read more:

[Adaptive Review of Three Fundamental Questions in Physics](#)

[Making up of Universe by Tiny Energy Including Unique Features](#)

[The Mechanism of Graviton Exchange between Bodies, Part I](#)

[The Mechanism of Graviton Exchange between Bodies, Part II](#)