

# The Introduction of Combinational Electro-Gravitation Principle to Explanation of the Microscopic and Macroscopic Phenomenon

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## ABSTRACT

*This article is going to show the new solution for unification of electrodynamics and gravitation using new concept of wave-particle duality, which is called Combinational Principle. First, it introduces several terms for efficient explanation of such a principle. Then it reviews the concept of wave-particle duality suggested by Rhee. The concept of wave-particle duality newly introduced here is based on indistinguishability between electron "chunk", and deviation from gravitational shortest path, and new 2 laws of existence. It expands this idea to gravitational field, and it introduces the new concept called combinational principle. This principle uses the new concept of wave-particle duality. It is followed by application of this new principle to fermionic movement which is usually described by Schrodinger equation. Additional effect of gravitation based on combinational principles will be shown. It again followed by another application on hyper macroscopic world of entire universe and black holes, and it naturally arrives at the conclusion on universe expansion.*

## Keywords

Combinational, Wave-particle duality, Black hole, Indistinguishability, Unified field theory.

## Introduction

Currently there is a major problem in physics society about unification between electrodynamics and gravitation. This issue stems from a misunderstanding of the atomic world introduced by the Copenhagen interpretation. It states that the existence of a particle in spacetime is fundamentally probabilistic. This interpretation is the reason why the 2 world unification was completely failed.

Therefore, new atomic world interpretation already is introduced by Rhee [1], which is based on fermionic indistinguishability of its identity. If this new interpretation of atomic world is used together with the gravitation which is also newly modified by Rhee [2], then the unification becomes possible. However, one more principle must be added to make unification possible, which is called combinational principle in this paper. To understand it easily, new understanding of Wave-particle

Duality introduced by Rhee [1] is needed. Therefore, review of this wave-particle duality will be provided followed by the explanation of actual combinational principle. Application of this principle to real atomic world and macroscopic universal world will be followed next.

To achieve this objective, the following condition is assumed.

1. Light speed and Planck constant  $h$  are considered to be 1
2. Einstein's summation convention is assumed.

## The Definition of Various Terms

Uncertainty Operator: It represents uncertainty (variation) of the variable next to the operator. It has the following form:

$$(-R)^c \delta x$$

The  $(-R)^c \delta$  will be called uncertainty operator, and  $c$  represents the direction of the uncertainty and is called spin. It also indicates the number of dimension of energy violation.  $R$  will be called  $R$  operator in this paper

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## Energy and Momentum

Energy must be defined in certain time interval. (Momentum must be defined in certain distance). The amount of Energy is the uncertainty of traveling path (or density of flux of possible traveling path) in the time interval per unit time. The amount of Momentum is uncertainty of traveling path (or density of flux of possible traveling path) in the distance interval per unit distance. If the energy or momentum value has positive real value, then the direction of the traveling path must be equal to the direction of shortest path. If the energy or momentum value has negative real value, the direction of the paths must be opposite to the direction of shortest path. The value can be pure imaginary number. If this is the case, then the direction of the traveling path must be perpendicular to the direction of the shortest path.

## Gravitational Wave function ( $\phi$ )

The complex number which describes the uncertainty of traveling path, with imaginary part which represents “uncertainty of traveling path in the direction perpendicular to the shortest path”, and real part which represents “uncertainty of traveling path in the direction parallel to the shortest path”. The form of this wave function must be represented by the following formula:

$$\phi = P' \delta x'$$

where  $P'$  is energy or momentum, and  $\delta x'$  is distance inside 4-dimensional spacetime.

## Electrodynamic Wave function ( $\psi$ )

Assume there are 2 objects (A and B) that are moving on the traveling path defined by gravitational wave function. The traveling path of A is assumed  $A'$  and the traveling path of B will be assumed  $B'$ . The 2 objects collided with each other at a spacetime point C while each one was traveling on their own path. If each object is identical to each other, then after the collision(C), even if traveling path of each object itself does not change after collision from the original path, it becomes scientifically impossible to distinguish these objects. It is impossible to tell which object is A or B after C. This state will be called a physically continuous state in this paper. The physically continuous state itself must represent deviation from their original path. After C, if the distance between the 2 indistinguishable objects is parallel to the traveling path, then the deviation from their original path after the collision caused by such a physically continuous state will be called time-like deviation from the traveling path. In contrast, if the distance between the 2 indistinguishable objects is perpendicular to the travelling path after collision, then the deviation from the travelling path will be called space-like deviation (from the original path).

Electrodynamic wave function is the function of complex number value which describes the deviation of certain existence, with imaginary part which represents “spacelike deviation”, and real part which represents “timelike deviation”. The photon,

which has zero mass, has a wave function with real number only because it deviates from their path only in “time-like” way. The half-spin fermion-like electron’s wave function is complex number, because it’s movement includes both space-like and time-like deviation

Wave density (Probability density): wave density is the real number which is represented by the following formula:

$$\int \phi \psi = \int E \delta t \times p_x \delta x \times p_y \delta y \times p_z \delta z \psi^* \psi \approx \int \psi^* \psi \delta x \delta y \delta z \approx 1$$

Then  $\psi^* \psi$  is called wave density.

Normalization: Make the integration of the whole wave density in the group of wave function to be 1. The wave density then becomes the rate between the number of the shortest path at certain spacetime and the number of the whole shortest path over the entire wave.

Cell: If certain existence travels only on the shortest path in spacetime, the number of traveling path of the existence must be 1, and it must be equal to energy times certain time interval, or momentum times certain distance, as the following equation shows:

$$E \delta t = p \delta x = 1$$

The spacetime where the equation above satisfies will be called cell.

## Review of Wave-particle Duality

According to Rhee, the following law must be applied to both electro-dynamical and gravitational existences [1].

The law of wave: Every existence including fermion and boson etc., which has energy of its own must be physically continuous to each other of the same identity.

The law of particle: The whole integration over wave density (probability density) of every existence after normalization must be integer multiples.

Wave: The existence which satisfies The Law of Wave and violates The Law of Particle.

It violates 2 laws of following The 3 Laws of Movement:

The Law of Energy Conservation

The Law of Relativity - The same physical law must be applied to any reference frame.

The Law of speed limit - every physical element including fermion, boson, etc. must not exceed light speed, and The Law of momentum conservation (These 2 laws are combined to 1 law).

Particle: The existence which violates The Law of Wave and satisfies The Law of Particle.

Every particle satisfies all The 3 Laws of Movement above. These satisfactions must be described by the whole integration of the existence's wave density to be integer multiples.

In electrodynamical world, waves are the existences which can be represented by (fermion, boson) wave function of values of complex numbers. It means that any existence including fermion and boson which can be represented by wave function is physically continuous itself, it satisfies The law of wave mentioned previously, therefore, all of them must violate 2 among The 3 Laws of Movement and satisfy only the other 1 law, and it always deviates from the shortest path, as wave function itself indicates.

In contrast to wave, particles are described by the integration of wave density to be real number integer multiples. It means that it represents particles, therefore it satisfies every The 3 Laws of Movement so that it always follows the gravitational and electrodynamical shortest path.

Similar principles can be applied to gravitational wave function. Like an electro-dynamical world, the existence of a gravitational world originated from deviation. "The deviation" in gravitational world is to let spacetime have multiple (not one) traveling path (not limited to one shortest path). The term "physically continuous" means that the corresponding spacetime has this deviation. Therefore, The Law of Wave in gravitational world is to let the spacetime have multiple traveling path. The gravitational wave function can be indicated by the following math term:

$$\varphi = E\delta t = p \delta x$$

where E means the number of (amount of) traveling path during the interval  $\delta t$ , which is called energy, and p means the number of (amount of) traveling path during the interval  $\delta x$ , which is called momentum.

Spin is the direction of movement of boson and fermion wave function which can be described by the following equation:

$$\varphi \psi = (-1)^c \delta \psi$$

$$\psi E (-1)^c \delta t = (-1)^c \delta \psi$$

$$\psi E = (-1)^c \delta \psi / \delta t$$

where  $c = c'' - c'$  is spin and  $\psi$  is boson or fermion wave function, and  $\varphi$  is gravitational wave function (or wave density).

The spin also indicates whether the corresponding spacetime is inertial or non-inertial, multiple or single traveling path. If spin

is 0, then the corresponding spacetime is inertial, and if spin is 1, then the spacetime is non-inertial (but limited to one traveling shortest path.). If the spin is neither 0 nor 1, then the spacetime has multiple traveling paths, and the gravitational wave function must not be integer. However, if the spin becomes 0 or 1, then the boson and fermion traveling path must be limited to single shortest path, so the gravitational wave function (wave density) must be integer, especially 1. The special spacetime in which average spin is 0 or 1 is called cell or closed spacetime and which is in the form of gravitational particles which satisfy the gravitational version of The Law of Particle.

The following new theorems must be introduced to gravitational spacetime.

1. The total energy inside the entire spacetime must be conserved in 3 or more than 3 dimensions.
2. The total potential energy inside the entire space-time changes in one or less than one dimension
3. The average spin of entire spacetime increases as time flows forward.

The first among the theorems above corresponds to The law of Energy Conservation among The 3 laws of Movement mentioned previously, and the second one corresponds to The law of Relativity, the third one corresponds to The law of Speed Limit - The law of momentum conservation combination. The spacetime which satisfies The Law of Wave is called open spacetime, which is physically continuous to the other spacetime, violates 2 among 3 laws above, and this violation must be represented by the gravitation wave function. The spacetime which satisfies The Law of Particle is called closed spacetime, whose entire wave density over the spacetime must be integer, and satisfies every 3 laws above.

Before defining Complex number gravitation wave function in tensor form, Complex number tensor must be defined, especially imaginary unit:

$$1. g_{ij} g^{jk} = \delta_i^k$$

(it will be called real unit tensor)

$$1. \overline{g_{ij}} \overline{g^{jk}} = -\delta_i^k$$

$$2. g_{ij} \overline{g^{jk}} = i_i^k$$

where  $i^k$  is called imaginary unit tensor.

Modified version of Einstein's full field equation is:

$$R_{\mu\nu} + \beta R g_{\mu\nu} - \alpha R^2 g_{\mu\nu} i = \kappa T_{\mu\nu}$$

where

$$\beta^2 + \alpha^2 = 1$$

and  $\alpha$  is the same as electrodynamic coupling constant tensor e.

Here  $\beta R g_{\mu\nu}$  is real part of gravitation wave function,

$$- \alpha R^2 g_{\mu\nu} i$$

is imaginary part of gravitation wave function.

$g_{\mu\nu} i$

indicates the direction orthogonal to  $g_{\mu\nu}$

and is not limited to one direction or a tensor, but can have infinitely multiple values of tensor. The amount of these groups is proportional to  $R^2$

The term

$$R^2 g_{\mu\nu} i$$

works as negative energy which increases and decreases potential energy in opposite way to positive energy.

The entire universe is one kind of closed space-time and satisfies all the 3 laws below:

1. Total energy inside entire universe must be zero.
2. Total potential energy inside entire universe doesn't change.
3. The average spin of entire spacetime increases as time flows forward.

Closed spacetime is the form of particle in gravitational world, and it exists in 2 kinds of forms in the real world: The one will be called "(spacetime) cell", and black hole (our universe is equivalent to "black hole"). Spacetime cell is the spacetime which is infinitesimal and surrounds fermion wave function.

Another form of closed spacetime is black hole. According to the new theorems above, the entire energy over the whole entire universe must always be zero, and negative energy of  $R^2 g_{\mu\nu} i$

must be introduced to the spacetime where curvature scalar is great enough to compensate positive matter energy. Black Holes are the spacetime with the greatest gravitational field, it means that inside the black hole there is strong positive energy (matter energy), but because of strong spacetime curvature, there must be compensating strong negative energy. Therefore, potential (potential energy exerted to unit mass) inside every black hole must not be negatively infinite as current physics theory suggests, although the potential itself must be negatively strong enough. It means that there is no literal event horizon with infinite negative potential because newly introduced negative energy compensates for the positive matter energy. The actual event horizon is on the radius  $3m$  (not  $2m$ ) of  $m$  which is the total energy inside black hole. (It will be called act-event-horizon in this paper). Assume the matter energy + negative energy is on the surface of the sphere with the radius  $r$  from the center of black hole. If the  $r$  is smaller than the radius of act-event-horizon, the matter energy + negative energy always moves in the speed of light because of strong gravitation field, and the total energy inside  $r$  must be summarized to  $1/3 r$  (not  $1/2 r$ ), so that the path on the surface of

the sphere always exactly becomes the gravitation shortest path of zero mass existence.

### Combination Principle

Combination Principle is the principle applied when different physical theories are applied to analyze nature. For example, If the 2 theories such as electrodynamics and gravitation theory must be applied at the same time to the same phenomenon, the Combination Principle together with these theories must be applied.

Combination Principle: There are 3 independent theories: electrodynamics, gravitation theory, and chromodynamics (strong force). When these theories are combined, every existence (for example, fermion in electrodynamics, which is the existence always described by wave function and integration of wave density). inside one theory must be wave, existences in another theory must be particle, the other is blank. (must be ignored).

Therefore, it is possible that the existences (fermion, boson) in electrodynamics are always wave, while the existences in gravitation (which represented by gravitation wave function defined above) are particles and chromodynamics is blank (ignored).

All the other combinations are possible, but the only combination in which chromo dynamics is blank will be described in this paper.

The weak force world does exist, but it cannot be independent. It means that it appears in any combination theory. It works as a "connection" or "glue" among the 3 independent theories.

### Wave-Particle Duality Revisited

The actual wave equation which every existence satisfies is in the form:

$$\begin{aligned} \psi &= \psi (-R)^c \delta \psi \\ \Rightarrow \psi &\text{ is in wave state, } \psi \text{ particle state.} \end{aligned}$$

$$\begin{aligned} \psi &= \psi (-R)^c \delta \psi \\ \Rightarrow \psi &\text{ is in particle state, } \psi \text{ wave state.} \end{aligned}$$

( $\psi$  is electrodynamic wave function,  $\psi$  is gravitational wave function,  $c$  is spin,  $(-R)^c \delta$  is uncertainty operator)

If gravitational wave function  $\psi$  has value 1 when it has the form of  $\psi = E \delta t$ , then in the equation  $\psi = \psi (-R)^c \delta \psi$ , uncertainty operator  $(-R)^c \delta$  becomes same as Hamiltonian operator, because gravitation wave function is:

$$\psi = \psi^* E (-R)^c \delta t = \psi^* (-R)^c$$

and the equation above becomes:

$$\psi^* E (-R)^c \delta t \psi = \psi^* (-R)^{c+d} \delta \psi$$

$$(-R)^{c+d} \psi^* E \psi = \psi^* \frac{\delta \psi}{\delta t}$$

If  $c = c' - c'' = 0$ , then the cell (spacetime) must be 0-spin inertial reference frame closed cell, and R becomes 1. The value of d is 1/2, -1/2, 0, and if d is 1/2, or -1/2, then

$$\psi^* E \psi = -i \psi^* \frac{\delta \psi}{\delta t}$$

$\psi$  must be fermion wave function, if d is 0, then  $\psi$  becomes zero mass boson like photon.

If gravitation wave function  $\varphi$  of momentum and distance  $\varphi = p \delta x$  is not exactly equal to 1, but  $\varphi = p \delta x = 1 + m^{1/2} V^{1/2} \delta x$ , then

$$\varphi' = \psi^* p (-R)^c \delta x - \psi^* m^{1/2} V^{1/2} (-R)^c \delta x = \psi^* (-R)^c$$

$$\psi^* p \delta x \psi - \psi^* m^{1/2} V^{1/2} \delta x \psi = \psi^* (-1)^{1/2} \delta \psi$$

$$\psi^* p \psi = -i \psi^* \frac{\delta \psi}{\delta x} + \psi^* m^{1/2} V^{1/2} \psi$$

Therefore, 
$$\psi^* E \psi = \psi^* \frac{p^2}{2m} \psi \approx -\psi^* \frac{\delta^2 \psi}{2m \delta x^2} + \psi^* V \psi$$

In contrast, if  $c = 1$ , then the cell must be 1-spin non-inertial reference frame closed cell. Gravitation wave function  $\varphi$  of momentum and distance must have imaginary component in one dimension, (as c itself indicates) therefore, total energy and momentum conservation law inside the cell must be violated in this dimension.

The value of d is still 1/2, -1/2, 0, and if d is 1/2, or -1/2, then the  $\psi$  represents non-zero mass vector boson.

If gravitational wave function  $\varphi$  has value 1 when it has the form of  $\varphi = m \delta \tau$ , then in the equation  $\varphi \psi = \varphi (-R)^c \delta \psi$ , uncertainty operator  $(-R)^c \delta$  becomes same as Lagrangian operator, because gravitation wave function is:

$$\varphi = \psi^* m (-R)^c \delta \tau = \psi^* (-R)^c$$

In contrast,  $E \delta t$  is not exactly 1, but  $\varphi' = E \delta t = 1 - e A_e \delta t$  and  $\varphi'' = p \delta x = 1 + e A_p \delta x$ , and  $E \delta t - p \delta x = m \delta \tau = 1$  then

$$\psi^* E \delta t \psi - \psi^* e A_e \delta t \psi = \psi^* (-1)^{1/2} \delta \psi$$

$$\psi^* E \psi = -i \psi^* \frac{\delta \psi}{\delta t} + \psi^* e A_e \psi$$

$$\psi^* p \delta x \psi - \psi^* e A_p \delta x \psi = \psi^* (-1)^{1/2} \delta \psi$$

$$\psi^* p \psi = -i \psi^* \frac{\delta \psi}{\delta x} + \psi^* e A_p \psi$$

$$\psi^* m \delta \tau \psi = \psi^* (-1)^{1/2} \delta \psi = \psi^* E \delta \tau (-1)^{1/2} \delta \psi - \psi^* p \delta x (-1)^{1/2} \delta \psi$$

$$\psi^* m \psi \approx \psi^* E \psi - \psi^* p \psi = -i \psi^* \frac{\delta \psi}{\delta t} + i \psi^* \frac{\delta \psi}{\delta x} + \psi^* e A \psi$$

, which is same as Dirac Equation

In contrast, if gravitation is in wave state, then the spacetime must be in open spacetime cell:

$$\psi \varphi \approx \psi \psi^* P (-R)^1 \delta x \approx J$$

$$\psi (-R)^1 \delta \varphi \approx \psi \psi^* (-R)^1 \delta (P (-R)^1 \delta x) \approx \square A \psi^* \psi = \psi (-R)^1 \delta \varphi \Rightarrow J = \square A$$

where P is 4 dimensional energy-momentum, x is 4 4 dimensional spacetime distance, J is the four-current density,  $\square$  is the d'Alembert operator, and d is 1/2, -1/2, 0

This logic can also be applied to Gravitation Full Field Equation:

First, the Vacuum Field Equation is:

$$R_{\mu\bar{\nu}} = 0$$

In Electro-wave and Gravito particle state, (in  $\psi$  wave  $\varphi$  particle state):

$$R_{\mu\bar{\nu}} - \varphi \psi = \varphi (-R)^{c+d} \delta \psi$$

$$\varphi = \psi^* (-R)^c g'_{\mu\bar{\nu}} dx = \psi^* (-R)^c g_{\mu\bar{\nu}}$$

$$R_{\mu\bar{\nu}} - (-R)^c g_{\mu\bar{\nu}} = \varphi (-1)^{c+d} \delta \psi$$

Here c is spin, and  $(-R)^c g'_{\mu\bar{\nu}}$  uncertainty operator in spacetime.

$$R_{\mu\bar{\nu}} - (-R)^c g_{\mu\bar{\nu}} = n T_{\mu\bar{\nu}}$$

If c is 0, then

$$R_{\mu\bar{\nu}} - R^0 g_{\mu\bar{\nu}} \approx 0$$

Therefore, the reference frame must be inertial.

The energy stress tensor must be in the following form:

$$\varphi (-1)^{0+d} \delta \psi = T_{nzm} \psi + T_{zm} A$$

$T_{nzm}$

: 4 indices nonzero mass energy operator tensor. It represents the operator when d is 1/2 or -1/2, which changes only phase(angle) of complex number of the following wave function, not magnitude.

It corresponds to the operator

$$-i \frac{\delta}{\delta t}$$

$\psi$

: 2 indices spin half fermion wave function. It consists of 4 orthogonal spin components of corresponding fermion.

$T_{Zm}$

: 4 indices zero mass energy operator tensor. It represents the operator when d is 0 which changes only magnitude of complex number (or real number) of the following wave function, not phase (angle).

A

: 2 indices spin 1 boson wave function. It consists of 4 orthogonal energy-momentum components of corresponding boson.

If c is 1 :

$$R_{\mu\bar{Z}} - (-R)^1 g_{\mu\bar{Z}} = R_{\mu\bar{Z}} + Rg_{\mu\bar{Z}}$$

The energy stress tensor must be in the following form:

$$\varphi(-1)^{1+d} \delta\psi = T_{nzm}A + T_{zm}A$$

In Electro-particle and Gravitational wave state, (in  $\varphi$  wave  $\psi$  particle state):

$$R_{\mu\bar{Z}} - e\varphi\psi = e\psi(-R)^1\delta\varphi$$

$$R_{\mu\bar{Z}} - e\psi(-R)^1\delta\varphi = e\varphi\psi$$

$$R_{\mu\bar{Z}} - e\psi(-R)^1 g'_{\mu\bar{Z}}\varphi = e\varphi\psi$$

$$R_{\mu\bar{Z}} - e\psi(-R)^1 g'_{\mu\bar{Z}}\psi^*(-R)^1 g_{\mu\bar{Z}} = e\varphi\psi$$

$$R_{\mu\bar{Z}} - e\psi\psi^*(-R)^{1 \times 2} g'_{\mu\bar{Z}} g_{\mu\bar{Z}} = e\varphi\psi$$

$$R_{\mu\bar{Z}} - eR^2 g_{\mu\bar{Z}}i = e\psi(T_{zm} + T_{nzm})A\psi$$

$$((-R)^d g'_{\mu\bar{Z}} g_{\mu\bar{Z}} = g_{\mu\bar{Z}}i)$$

e on each side is the coupling constant tensor, it represents the proportion between gravitational particle - electro-dynamical wave state and gravitational wave - electro-dynamical particle state.

### Microscopic Application of Combination Principle to Electro-Gravitation Theory

Assume there is nothing inside spacetime except gravitational curvature  $R_{\mu\nu}$ . Then following equation must be applied to the vacuum spacetime:

$$R_{\mu\bar{Z}} = 0$$

There must be no energy exchange between each infinitesimal spacetime, so every infinitesimal spacetime is closed spacetime. Inside the closed spacetime, there is vacuum fluctuation, and it consists of fermion and boson of positive and negative energy and every 4 possible spins(1, 0, 1/2, -1/2), and the average spin is 0, and the average energy is 0. With the proportion of coupling constant tensor e, the closed spacetime converts itself to open spacetime. In each cell in microscopic world, open spacetime cells always convert its average spin value. Original value was 0, therefore the average spin of the cell must be converted to 1. After the open spacetime is converted to closed spacetime again, the equation of existence inside the cell becomes:

$$R_{\mu\bar{Z}} + Rg_{\mu\bar{Z}} = T_{zm}A + T_{nzm}A + T_{comp}$$

Where  $T_{comp}$  has random arbitrary value just to show that right- and left-hand term of the above equation is not exactly equal. It represents gravitational particle - electro-dynamical wave state. If there is gravitational particle - electro-dynamical wave state, then there is also gravitational wave - electro-dynamical particle state. In this state, the corresponding spacetime changes to open spacetime

and electro-dynamical wave changes to particle state. The open spacetime makes electro-dynamical wave change the average spin 1 to 2 half spin particles (with 0 average spin), one particle and the other anti-particle (for example, electron and positron). Therefore, the corresponding equation changes to:

$$R_{\mu\bar{Z}} - eR^2 g_{\mu\bar{Z}}i = e\psi(T_{zm} + T_{nzm})A\psi$$

e on each side is the coupling constant tensor, it represents the proportion between gravitational particle - electro-dynamical wave state and gravitational wave - electro-dynamical particle state.

The spin 1 boson A in above equation create finally spin 1/2 fermion wave function inside spacetime.

The equation of spacetime then must be:

$$0 = T_{zm}A + T_{nzm}\psi + T_{comp}$$

$$\Rightarrow (1)$$

which corresponds to Dirac equation of Quantum Mechanics.  $\psi$  represents spin 1/2 fermion which consists of 4 orthogonal components, which are left-handed and right

handed spin fermion wave functions, respectively. These wave functions are in the

Electro-dynamical wave state, therefore, the spacetime which surrounds these existences must be in particle form(closed spacetime).  $T_{comp}$  is the term of randomized value just to represent that

$$TA + T\psi$$

is not zero.

The above equations describe electro-dynamical wave - gravitational particle state, and with the proportion represented by the coupling constant tensor e, it again changes their state to the following electro-dynamical particle - gravitational wave state:

$$R_{\mu\bar{Z}} - eR^2 g_{\mu\bar{Z}}i = e\psi(T_{zm} + T_{nzm})A\psi$$

$$\Rightarrow (2)$$

Right hand side of the equation above consists of 2 1/2 spin fermion wave function and 1 spin boson wave function because gravitational open spacetime causes spin 1 boson to change into 2 1/2 fermion wave function or, vice versa.

The 2 equations((1) and (2)) above can be combined into 1 equation, and the term

$$R_{\mu\bar{Z}} - eR^2 g_{\mu\bar{Z}}i$$

and  $T_{comp}$ , and  $e\psi T_{nzm}A\psi$  compensates each other to be zero, and the combined equation becomes:

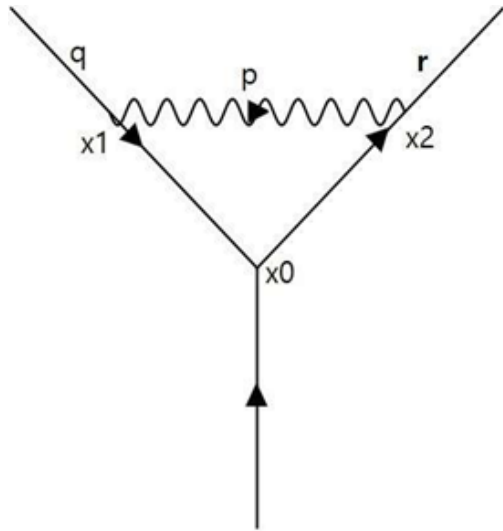
$$0 = T_{zm}A + T_{nzm}\psi + e\psi T_{zm}A\psi$$

(Dirac Equation).

With this new theory one can get Feynman amplitude for reaction of one fermion and boson in a new way.

Feynman amplitude for reaction must be obtained by application of equation of open spacetime. This equation is approximately same as the equation of spin 1 closed spacetime minus the equation of spin 0 closed spacetime, because during open spacetime the spin changes from 0 to 1 or 1 to 0.

The equation of spin 0 closed spacetime is same as the Dirac equation. Therefore, it can be obtained by applying normal Feynman rules.



**Figure 1:** Feynman Diagram of Reaction Between One Fermion and One Boson.

Following Feynman Diagram describes the reaction of one external electron and one external photon:

In the diagram above, the photon propagator with momentum  $p$  in closed spacetime cell is:

$$\frac{1}{p^2 + i\epsilon}$$

The equation of spin 1 closed spacetime is not the same as the Dirac equation. However,

Dirac equation can still be applied approximately with the nonzero vector boson instead of photon. The propagator for nonzero vector boson is:

$$\frac{1}{p^2 - \Lambda^2 + i\epsilon}$$

where  $\Lambda$  is the energy of the 1 closed spacetime. Therefore, the actual propagator in the open spacetime must not be symmetrical, and must be described by the following form:

$$\frac{1}{p^2 + i\epsilon} - \frac{1}{p^2 - \Lambda^2 + i\epsilon}$$

Therefore, according to Feynman rules, the entire modified propagator of the above Feynman Diagram is:

$$(ie\gamma)p_f(q-p)(ie\gamma)p_f(r+p)(ie\gamma)\left(\frac{1}{p^2 + i\epsilon} - \frac{1}{p^2 - \Lambda^2 + i\epsilon}\right)$$

where  $p_f(p)$  is fermion propagator. Feynman amplitude is:

$$F = \int \frac{d^4p}{2\pi^4} (ie\gamma)p_f(q-p)(ie\gamma)p_f(r+p)(ie\gamma)\left(\frac{1}{p^2 + i\epsilon} - \frac{1}{p^2 - \Lambda^2 + i\epsilon}\right)$$

Here  $\Lambda dt$  represents gravitational wave function of entire spin 1 closed spacetime in time interval of  $dt$  and according to the law of Particle, it must be value of integer 1.

### Macroscopic Application of Combination Principle to Electro-Gravitation Theory

First, assume that the spacetime without all Black Holes in the entire universe will be called Rest Universe, and assume that the spacetime in the entire universe including all Black Hole and Rest Universe will be called Total Universe.

There is another kind of closed gravitational spacetime which is gravitational particles. The microscopic gravitational particle is the closed spacetime with entire integration of the wave (probability) density to be the average spin of the spacetime. Similarly, the integration of macroscopic one must also be integer unity (one), and that must be so called "Black Hole" by current physics. It corresponds to the closed spacetime of spin 1. In contrast, Total Universe is also a kind of closed spacetime with spin 0 instead. Rest Universe is the open spacetime which connects between Black Hole and Total Universe. Therefore, the following equation must be satisfied

$$R_{\mu\bar{\nu}} + Rg_{\mu\bar{\nu}} = nT_{\mu\bar{\nu}}$$

by Black Hole, and

$$R_{\mu\bar{\nu}} - R^2g_{\mu\bar{\nu}}i = nT$$

by Rest Universe.

If the total matter energy in Black Hole increases, the potential energy in Black Hole decreases. Total matter energy inside entire Total Universe must be zero, therefore, total matter energy in open spacetime Rest Universe must decrease. In contrast, potential energy inside Rest Universe must increase. It means that as total matter energy in Black Hole increases, The Total Universe must expand. (increasing potential energy itself means universe expansion)

### References

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