G complex mass theory

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Abstract. Zhou Yi said, “Wuji (No have) born Tai Chi (have), Tai Chi born two state of affairs”. Tai Chi is the smallest unit of substance. The two state of affairs are real (G particle) and imaginary (field). The real state is the particle state (g particle) formed by the accumulation of Tai Chi. The imaginary state is the field (wave) state formed by the evacuation of Tai Chi. The motion of g particles in complex space-time to form quarks and leptons, Neutrinos are magnetic monopole. The field state and the particle state are both opposite and unified, and they transform each other. The Chinese diagram of the universe best defines the qualitative description of this relationship. The complex in mathematics can quantitatively describe the contradiction-the insides of things are opposite and unified in mutual conversion. All the elementary particles (fermion and bosons) are different motions of the sample particle in complex space-time. The real part of physical quantity reflects the Feynman geometry of the particle (fermion) that is macroscopic and non-linear; the imaginary part represents the Lobachevsky geometry that is microscopic, linear and fluctuating (bosons). The real part of electromagnetic force satisfies Coulomb law, and its imaginary part meets Lorentz law. The real part of mass force satisfies Newton’s law of universal gravitation, and its imaginary part meets Coriolis law. The real part of energy constitutes the macroscopical mass-energy equation of Einstein, and the imaginary part forms the Planck equation of microscopical quantum. The rest mass of electron and the charge are not in the same space, but satisfy the relationship between real and imaginary parts. The theory can explain the tests by Hao Ji, Jinsong Feng, Qi Liu, et al. It also shows that the charges with the same nature repulse each other, but attract each other with the different natures; on the contrary, the masses with the same nature attract each other. The theory can fundamentally solve the divergence in quantum field.

1. Introduction
In twenties century, the main theories quantum mechanics and general theory of relativity came into the world. In quantum mechanics, the classic express method of energy and momentum is replaced by introducing the virtual unit i, which achieves the effect of quantization (complex). Then, this application has got rapidly development and been supported by continuous experiments.

As early as 1915, Einstein published the general theory of relativity with a huge success, some experiments even put the theory to a higher position such as perihelium precession of mercury and that light is bent when pass through gravitational field. However, the correctness of this theory is determined relatively, to some degree, it has limitations. The main deficiency is that it can only reflect the curvature characteristics of the space without consideration for torsion characteristics. At present, only general relativity theory does not employ with quantization (plural). Some achievements have been made in studying on twister theory in recent years with an attempt to use quantization on an overall level.
Gauge field is virtual space (time) field. The gauge transformation described by the space-time angle (in complex space-time) is a non-local transformation, and the local gauge transformation is formed by the projection of the non-local transformation in the space.

In this paper, the first standardized transformation \( \psi \rightarrow \psi e^{ip} \) was employed to achieve standardization of gravitational force \([1]\) (complex), during this process quite a lot of results have been attained.

2. G complex mass
Lao Zi said: Dao born one, one born two, two born three, three born things. Zhou Yi said: Wuji (No have) born Tai Chi (have), Tai Chi born two state of affairs, two of affairs born four phenomenon. In the early days of the universe, the universe had a cosmic quantity \( \text{Dao} \) such as energy. \( \text{Dao born one} \) is the process of generating the smallest particle \( \text{Taiji} \) from the cosmic quantity (energy), which is also the process of \( \text{No have born have} \). \( \text{One born two} \) is the process of \( \text{Tai Chi born two state of affairs} \):

The two of affairs are particle states (g particles belong to fermions) and field (y particles, belong to bosons).

The accumulation of Taijions results in g particles (the fermion state). The different motion states of g particles in complex space-time form elementary particles quark and lepton.

The Tai Chi disperse form field-state particles (boson state). There is no essential difference between the two states, except that the same material \( \text{Taiji} \) stores different forms of the universe.

In other words, particles and fields are different forms of \( \text{Taijions} \) of the same material.

The particle state is nonlinear, cannot be superimposed, and satisfies the Riemannian space property, and the field state is linear and superimposed, satisfying the property of Robacev space.

The particle state and the field state of matter are a pair of contradictory bodies which are both opposite and unified and reciprocal transformation. The mathematical model that can accurately describe the relationship between these two forms is the complex number. The Tai Chi (matter) function is [2]:

\[
\psi(X) = \psi_0(X)e^{it} = \psi_0(X)e^{i\frac{\hbar c}{2} \left( \cos \left( \frac{ct}{s} \right) - i \sin \left( \frac{ct}{s} \right) \right)}
\]  

The upper expression is the time varying representation of the g universe. \( \psi \) is Function, \( X \) is the property of matter (which can be mass, charge, energy, etc.) according to the theory of G complex space-time:

\[
s = s_r + is_i = r + ic t
\]

So:

\[
\psi(X) = \psi_0(X)e^{i\omega t} = \psi_0(X)e^{i\omega t} \cos ct + i \psi_0(X)e^{i\omega t} \sin ct
\]  

The upper expression is G-time-varying function Made

\[
\psi_r(X) = \psi_0(X)e^{i\omega t} \cos ct
\]  

Because \( r \) (spatial distance) changes with time t. So this equation reflects the expansion and contraction of space-the spatial pulsation.

\[
\psi_r(X) = \psi_0(X)e^{i\omega t} \sin ct
\]  

This equation reflects the quantization of the field (wave packet).

Can be written:

\[
\psi(X) = \psi_r(X) + i \psi_i(X)
\]  

(4)(5) For (4) (5) type one and two order partial differential:

\[
\frac{c \partial \psi_r}{\partial x} = \frac{\partial \psi_r}{\partial t}
\]
\[ \frac{\partial \psi_i}{\partial t} = -c \frac{\partial \psi_i}{\partial x} \]  

(7)(8) Cauchy Riemann equation  
\[ i \frac{\partial \psi}{\partial t} = -c \frac{\partial \psi}{\partial x} \]  

The upper equation is g space-time equivalent equation. In other words, the spatial variation of cosmic quantity (such as energy) can always be achieved by changing in time. On the other hand, the time change of the universe can always be realized by the change in space.

\[ \frac{\partial^2 \psi}{\partial t^2} = -c^2 \frac{\partial \psi}{\partial x} \]  

The upper equation is G vibration equation.

\[ i \frac{\partial \psi}{\partial t} = -c \frac{\partial^2 \psi}{\partial x^2} \]  

Schrodinger equation

\[ \frac{\partial^2 \psi}{\partial t^2} = -c^2 \frac{\partial^2 \psi}{\partial x^2} \]  

The upper expression is the classical wave equation. The general equation of G is given below.

\[ \frac{\partial^k \psi}{\partial t^k} = (ic)^k \frac{\partial^k \psi}{\partial x^k} \quad (k, j=1,2,3...) \]  

Because

\[ \psi(X) = \psi_0(X) e^{i \omega t} = \psi_0(X)e^{\hbar (\cos \theta + i \sin \theta)} = \psi_0(X) e^{\frac{\hbar}{2c} \sqrt{1 - \frac{v^2}{c^2}} e^{\frac{im}{\hbar} \frac{v}{c}}} \]  

The upper form is a representation of the velocity change of the g universe. When the object is small or moving at high speed,

Have \[ e^{\epsilon} = e^{\frac{\hbar}{2c} \sqrt{1 - \frac{v^2}{c^2}}} \approx 1. \]

In future discussions, suppose \( e^{\epsilon} = 1 \).

The upper formula is realized into a circle with a constant radius in the plane of complex spacetime. The real part of the upper formula reflects the properties of the particle. The imaginary part reflects the characteristics of the field (wave).

The upper formula is realized into a circle with a constant radius in the plane of complex spacetime. The upper real part reflects the properties of the particle and the imaginary part reflects the field (wave) property.

So The mass function of matter is:

\[ \psi(m) = \left[ \psi(m) \left[ \cos(ct) + i \sin(ct) \right] \right] \]

\[ = \left| \psi(m) \right| \sqrt{1 - \frac{v^2}{c^2}} - i \left| \psi(m) \right| \frac{v}{c} \]  

The upper form can be abbreviated to:

\[ m = m_r + im_i = \left| m \right| \sqrt{1 - \frac{v^2}{c^2}} - i \left| m \right| \frac{v}{c} \]  

Real mass (rest mass) embodies the particle (fermion) property of a substance, while the virtual mass (dynamic mass) embodies wave property (boson) of physical-field, which is main source of dark matter and proportional to moving speed. These analyses lay a good foundation for theory that all substances have the property of wave-particle duality. For a complex mass, the real part presents with a Riemann geometric space when expanded, while the virtual part presents with a Roche geometric
space (speed space) when expanded. Roche space takes speed as radius and its limited radius is the speed of light. Generally speaking, all substances are constituted of entity of contradiction in that real mass and virtual mass is not only opposite but also interlinked to each other, in the meanwhile they can achieve mutual transformation.

Therefore, we have:

$$m = m_r - i \frac{p_r}{c}$$  \hspace{1cm} (17)

$|m|$, as module of particle mass (the gross mass), is an invariant, while $m_r$ and $m_v$ vary by $v_r$. That is to say, when $v_r = 0$, $m_r = |m|; m_v = 0$, and when $v_r = c$, $m_r = 0; m_v = -|m|$. To put it in another way, when the speed of an object is equal to zero, the real mass (i.e. the rest mass) of the particle is in maximum level equal to gross mass, as speed increases the rest mass will decrease gradually, while the virtual mass keeps increasing, but the module of mass (total mass of orbit) keeps the same. When speed reaches to light level, the rest mass reduces to zero, whereas the dynamic mass reaches the peak. If the speed keeps increase, the rest mass will instead exist in negative from, that is to say it has changed into antimatter. This analysis provides a good explanation to the fact that when gyroscope rotates it will become less heavy (rest mass of an object in motion decreases with the increase of speed). The introduction of complex mass helps to solve the divergent problems that when an object moving at a speed approaching to light level, its mass will become infinite.

3. Static charge and static mass

Because $h = 2\pi \hbar, \omega = 2\pi f$, we can get:

$$E = m_r c^2 - i\hbar \omega \xi, \hspace{1cm} \xi = \frac{h}{|m| v_r}, \hspace{1cm} E = E_r - icP_r, \hspace{1cm} \lambda_r = \frac{v_r}{f_r}, \hspace{1cm} f_r = \frac{c}{v_r}$$

The first term on the right of the upper formula is the famous Einstein equation of mass and energy, which reflects the static macroscopic energy state. The second is the famous Planck energy formula, which reflects dynamic microscopic energy states. The upper formula unifies the energy of the two forms in one equation.

Instruction: Static mass is formed during the transformation of virtual space energy (time energy) through velocity to real space (space). (see figure 1).

$$f_r, \omega, \xi$$ signifies for the photon vibration frequency and circular frequency, $E$ signifies for the total energy of particle, $m_r$ for the particle static energy (spatial energy).

According to G complex space-time theory,
We can get
\[ q = a = \hbar \omega^2 \]  \hspace{1cm} (19)

Amongst which \( a \) signifies for the synthesized centripetal acceleration of quantum photon in circumferential uniform motion in the complex space-time, \( q \) signifies for the complex charge (electromagnetic charge).

Let’s bring the above formula into formula (18), we can get:
\[ E = m_c c - i \sqrt{\hbar q} \]  \hspace{1cm} (20)

Amongst which \( m_c \) signifies the static (real part) mass, and \( “E” \) signifies the total energy of particles. The above formula is G mass-electro complex formula.

Formula (20) indicates:
1). Particle charge and its static mass are real-imaginary relation of unity of opposites and mutual transformation.
2). They are not in the same space, they are located in two orthogonal spaces. They meet the following relationship:
\[ E^2 = (m_c c^2)^2 + q \hbar \]
Namely:
\[ q = -m_c^2 \frac{c^4}{\hbar^2} + \frac{E^2}{\hbar} \]  \hspace{1cm} (21)

Given the charge as the ordinate whilst the static mass the abscissa, as the quadratic term is negative, the parabola opens down, the polar coordinates being (0, \( \frac{E^2}{\hbar} \)). As \( \Delta = b^2 - 4ac = \frac{4c^4E^2}{\hbar^2} > 0 \), the parabola has two intersections with the horizontal axis.

3). Charge and static mass meets the parabolic relationship, that is, there exists relation between charge and the square of static mass. So, electricity power is stronger than gravitation.

4). When the static mass of particles is zero (i.e. photon), its charge is not zero, and the charge value is:
\[ q = \frac{E^2}{\hbar} \],
Namely:
\[ E^2 = \hbar q \]  \hspace{1cm} (22)

The above formula is G photon charge formula.

Therefore, it can be predicted that the photon carries a small amount of electromagnetic charge, hence the electromagnetic oscillation can be formed, then electromagnetic wave can be formed, so it could propagate without media in the vacuum. Therefore, when light passes through the magnetic medium (or in the external magnetic field), the polarization, phase and scattering characteristics of the photons will alter, which have been corroborated by magneto-optical Faraday effect, Magneto-optic Kerr effect, magnetic birefringence, Zeeman effect, magnetic excitation light scattering and others.

5). When the charge is zero (i.e. neutrino), the static mass are of two non-zero yet respectively positive or negative values. Such is positive and negative neutrinos. Its static mass is:
\[ m_e = \pm \frac{E}{c^2} \],
Namely:
\[ E = \pm m_c c^2 \]  \hspace{1cm} (23)
The afore-mentioned formula signifies the G neutrino static mass, amongst which $\pm m_\nu$ is the static mass of the positive and negative neutrinos.

The neutrino’s weak static mass has been corroborated by neutrino oscillations. In addition, the photon can also be mutually transformable with neutrinos, hence the formation of light neutrino oscillation.

4. **G complex mass force temperature**

Supposed that there are two objects $m_1$ and $m_2$ on a complex plane, $m_1$ stays at the origin of coordinate, and $m_2$ stays at Q point moving at the speed of light.

So we conclude that:

$$F_r + iF_s = -G \frac{m_1 m_2}{s^2} (\cos \theta + i \sin \theta)$$

And above expression is G complex mass force equation

Combined with G complex space-time theory, coming that:

$$F_r + iF_s = -G \frac{m_1 m_2}{s^2} \sqrt{1 - \frac{v_r^2}{c^2}} - i \frac{v_r}{c}$$

($v_r$ represents projection of moving speed from in space-time to space, which is just the moving speed measured in real space)

Above equation is the speed equation for G complex mass force, in which the real part is

$$F_r = -G \frac{m_1 m_2}{s^2} \sqrt{1 - \frac{v_r^2}{c^2}}$$

And this equation is the speed equation for G real mass force.

And the virtual part is:

$$F_i = G \frac{m_1 m_2}{s^2} \frac{v_r}{c} = \frac{a}{c} m_2 \times v_r = \frac{s\omega^2}{c} m_2 \times v_r = m_2 \hat{\omega} \times \hat{v}_r$$

(\(\omega\) stands for rotation angular frequency)

This formula displays the virtual mass force, also called Coriolis’ force.

If $v_r = 0$ then $F_r = -m_2 g$; $F_i = 0$

If $v_r = c$ then $F_r = 0$; $F_i = m v_r \times \omega$

If $v_r > c$, then $F_i$ changes into a virtual value (equivalent to negative value) and gravitational force will convert to a repulsion force.

Note: When object moves at a speed of zero, real mass (gravity) shall be the maximum, while virtual mass force (Coriolis’ force) is equal to zero. Gradually, when the speed reaches to light level, real mass will decrease to zero, meanwhile virtual mass force reaches the limit. At this point, the object is free from real mass force (gravity) from space. The velocity of a body does not increase, but it is subjected to a dynamic force, which deflects the moving matter in the field. All of this can explain why the movement direction of photon with a rest (real) mass of zero is changed when moving to surrounding areas of massive objects. Under the condition that the object moves at a speed of zero, the G rest mass formula of universal gravitation will become Newton’s Formula of Universal Gravitation, which indicates that Coriolis’ force only changes direction of moving object with no effect on the speed. With effect of Coriolis’ force, particle will move in spiraling motion. Further when the speed exceeds to light level, the real mass force existed in real space will change into gravitational repulsion.

Setting;
\[ v_c = \frac{cT}{|F|} = \frac{cT}{T_c} \]  

(28)

T may be temperature, \( T_c \). Temperature corresponding to the speed of vacuum light. The temperature is a constant and is the upper limit of the temperature.

Bring (28) to (25):

\[ F = G \frac{Mm}{s^2} \left| 1 - \frac{T^2}{T_c} - i \frac{T}{T_c} \right| \]  

(29)

Formula (29) the real part is the correction formula of the temperature of the gravitation.

Upper description
The higher the temperature of the object, the smaller the absolute value of the gravitation.

Otherwise, the lower the temperature, the greater the absolute value of the gravitation.

It can be deduced by thermodynamics that the faster an object moves, the smaller the absolute value of the gravitation is, otherwise, the smaller the velocity, the greater the absolute value of the gravitation.

5. Electromagnetic force and temperature
Electromagnetic force is:

\[ \vec{F} = \vec{F}_r + i\vec{F}_s = |qE| (\cos \beta + i \sin \beta) = -|qE| (\cos \hat{\theta} + i \sin \hat{\theta}) \]

\[ = -|qE| \left[ 1 - \left( \frac{\vec{v}_r}{c} \right)^2 + i \frac{|E| \times \vec{v}_r}{c} \right] \]  

(30)

Cause: \(|E| = c|B|\), have:

\[ \vec{F} = \vec{F}_r + i\vec{F}_s = -q_r \cdot \vec{E} + iq|B| \times \vec{v}_r \]  

(31)

Note: the real part of the upper formula is negative, Represents the formation of gravity between charges (spatial effect). The real part of the formula is the classical Coulomb force. The imaginary part is a magnetic force perpendicular to the power (Lorentz force).

Due to the uncertainty principle of quantum fluctuation when the two charges are very close, the momentum (rate) of its electrons can be great (close to the speed of light), so the real department will have:

\[ \vec{F}_r = -k \frac{q_1q_2}{R^2} \sqrt{1 - \left( \frac{\vec{v}_r}{c} \right)^2} = 0 = k \]  

(32)

So there’s no infinity at the singularity
In the same way:

\[ F = |qE| \left( 1 - \frac{T^2}{T_c} - i \frac{T}{T_c} \right) \]  

(33)

Formula (33) the real part is the correction formula of the temperature of the Coulomb force.

Upper description
The higher the temperature of the object, the smaller the absolute value of the Coulomb force.

Otherwise, the lower the temperature, the greater the absolute value of the Coulomb force.

It can be deduced by thermodynamics that the faster an object moves, the smaller the absolute value of the Coulomb force is, otherwise, the smaller the velocity, the greater the absolute value of the Coulomb force.
6. Color force

Definition of color force: \( F = Sb \) “b” Where b is the color charge (plus acceleration), “S” signifies quantity correlating to color force. “S” is likely to be mass (hereafter hypothesized as mass “m”).

After expanding to quaternion, is:

\[
F = F_0 + \bar{F} = -\frac{e^2}{R^2} |m|((\bar{v}_x + \bar{v}_y + \bar{v}_z) + \bar{c}|m|\sqrt{1 - \frac{v^2}{c^2}})
\]

in which \(|m|\) is the module value of mass.

The aforementioned formula indicates:

1) Real-color force is proportional to the product of particle energy and motion velocity, and the greater the energy, the larger the absolute value of real color force. Because the particles in the initial or microscopic world of the universe are in high - energy and high - speed state, the solid color force intensity in the initial or microscopic field of the universe is far greater than the other forces. Color force is in the opposite vector to particle velocity, this feature determines that the quark is closely confined.

3) When the two quarks shot close to each other, the relative velocity between them gradually reduces, so the color force also gradually reduces. This is the reason for the quark asymptotically free [4].

4) The space angle of quark is greater than zero yet less than 90 degrees, so quark carries fractional charge and color charge.

5) Because the typical fermion is located in the space and its space-time angle is zero, the color force of the typical fermions, (such as \( e^\tau, \mu, \tau \)) is zero, so it does not participate in the strong action. The strong action in the color space does not change the space-time angle (that is, the conformal). So the color action (strong interaction) does not change the static charge and the static mass of the particle (Static charge and static mass conservation in strong interaction).

7. Quark weak force

The complex momentum is:

\[
F_r = mv = |m|c(-\sin \theta + i \cos \theta) = -|m|v_r + |m|c\sqrt{1 - \frac{v^2}{c^2}}
\]

Weak charge: the velocity vector of a particle in a complex space-time opens up the time dimension. Its projection in space forms a weak charge. That is:

\[
v_r = -c \sin \theta
\]

The weak force is defined as the real part of the complex momentum of the particle (projecting in the space), forming the weak force. That is:

\[
F_r = -|m|c \sin \theta
\]

where \( v \) is the velocity. \(|m|\) is in the quality of the films.

Description of the formula: The real weak force is proportional to the absolute value of the momentum, the greater the absolute value of the momentum, the stronger the weak force, the easier the decay is.

The weaker force is related to the space-time angle (particle velocity), the greater the space-time angle (velocity), the stronger the weak force, the more the time-space angle (90 degrees) of the neutrons is larger than the space-time angle (0 degree) of the proton, so the neutrons decay more easily with respect to the protons.
8. G particle model

8.1. G particle space-time angle

When \( i = 1 \), \( \theta = -\pi/6 \), there are quarks (u, c, t); when \( i = 2 \) and \( \theta = 0 \), there is positive lepton (\( e^+, \mu^+, \tau^+ \));

When \( i = 3 \), \( \theta = 2\pi/6 \), there are quarks (d, s, b); when \( i = 4 \), \( \theta = \pi/2 \), there are antineutrinos (\( \bar{e}^\nu, \bar{\mu}^\nu, \bar{\tau}^\nu \)).

Calculation formula of complex space-time angle of constra-lepton and contra-neutrino is \( \bar{\theta} = \pi - \theta \); thus, complex space-time angle of lepton (\( e^+, \mu^+, \tau^+ \)) is \( \pi \) and complex space-time angle of neutrino (\( e^- \), \( \mu^- \), \( \tau^- \)) is \(-\pi/2\) (different spinning chirality between contra-neutrino and neutrino).

Calculation formula of complex space-time angle of antiquarks is \( \bar{\theta} = \pi/2 - \theta \); thus, complex space-time angle of antiquarks (\( u^\nu \), \( c^\nu \), \( t^\nu \)) is \( \pi \); space-time angle of antiquarks (\( d^\nu \), \( s^\nu \), \( b^\nu \)) is \(-\pi/6\).

8.2. G particle energy level

For the purpose of vivid understanding, (see figure 2). When \( G_i \) particle rotates around energy axis on orbits of different imagery level in G coordinate system, lepton, neutrino and quark of the different ages are formed; that is, all quarks and leptons are different expression forms (states of motion) of the same G particle in G coordinate system. \( i \) is quantum number of space-time angle, \( i = 1,2,3,4 \); \( j \) is number of energy channels, \( j = 1,2,3 \) (as shown in figure 3). Thus:

\[
\begin{align*}
G_{11} &= \text{up quark } u \\
G_{12} &= \text{charmed quark } c \\
G_{13} &= \text{top quark } t \\
G_{21} &= \text{lepton } e^+ \\
G_{22} &= \text{lepton } \mu^+ \\
G_{23} &= \text{lepton } \tau^+ \\
G_{31} &= \text{down quark } d \\
G_{32} &= \text{strange quark } s \\
G_{33} &= \text{bottom quark } b \\
G_{41} &= \text{antineutrino } \bar{e}^\nu \\
G_{42} &= \text{antineutrino } \bar{\mu}^\nu \\
G_{43} &= \text{antineutrino } \bar{\tau}^\nu \\
\end{align*}
\]

The magnetic charge number is in the upper left corner of the element.

**Figure 2.** G particle R-T coordinate system.  **Figure 3.** G Super complex spatiotemporal fiber bundle.

Neutrinos are magnetic monopole. The quadrupole radiation of gravitational radiation form by charged lepton and neutrino and quark at a space-time angle \( -\pi/6 \) and quark at a space-time angle \( 2\pi/6 \).

Definition: neutrino band with a negative magnetic charge (negative weak charge), anti-neutrino band with a positive magnetic charge (weak charge). The magnetic charge number is in the upper left corner of the element.
Weak action G law: before and after weak action charge, magnetic charge (weak charge) conservation.

For example, 1) neutrons decay into protons:

\[ n^0(udd) \rightarrow p^+(uud) + e^- + \bar{\nu}_e \]  

(38)

\[ +n^0(udd) \rightarrow 0^+p^+(uud) + 0^-e^- + 0^+\bar{\nu}_e \]  

(39)

For ease of writing, the zero and anti-neutrino lines in the upper right and left corners of the element can be omitted. That is, \[ +n(udd) \rightarrow p^+(uud) + e^- + \nu_e \]  

(40)

Weak action G theorem: On the plane of complex space-time, When A point particle rotates to B point particle, It will release the substratum (or lower energy) particle \( \tilde{a} \) with similar to the A point particle and substratum particles (or lower energy) \( \tilde{B} \) with similar antiparticle properties of B.

For example, 2)

\[ \mu^- \rightarrow e^- + \bar{\nu}_e + \nu_\mu \]  

(41)

\[ \bar{\mu}^- \rightarrow e^- + \nu_e + \bar{\nu}_\mu \]  

(42)

The essence of the upper form is: when the lepton \( \bar{\mu}^- \) revolving counter clockwise \( \pi^2 \), will become electrically neutral with a negative weak charge \( \nu_\mu \). At the same time, the particle will release a negatively charged electron \( e^- \) and an anti-electron neutrino (with a positive weak charge) \( \nu_e \). The conservation of charge number on both sides of the reaction and the conservation of weak charge number.

9. G vacuum model

G theorem of 1: Visual interface with light - speed moving substance, this visual interface constitutes a vacuum relative to space.

G theorem of 2: vacuum is physical state of static quality is zero.

G theorem of 3: in vacuum, a substance exists in the form of a wave.

G theorem of 4: vacuum material meets the linear relationship.

G theorem of 5: vacuum material state can be superimposed.

G theorem of 6: vacuum physical state is the Non dispersion (zero dispersion degree)

G theorem of 7: vacuum full of negative energy.

G theorem of 8: the vacuum is holographic, each point (vacuum) contains material information.

The information stored in the form of holographic interference on the event horizon surface (smooth), as holography is the 3 d images stored in the form of two dimensional holographic coding on the interference in the film.

G theorem of 9: Vacuum is composed of boson ocean

G theorem of 10: The vacuum can be defined as an open string. Can also said the open string constitutes the vacuum.

G theorem of 11: Vacuum (in the interface of the speed of light, movement of the material) can Shield gravity.

G theorem of 12: in non-inertial system, the momentum of isolated system, color, charge, static quality are no longer conserved, but still the energy conservation.

G theorem of 13: the vacuum field is zero dimensional, and the excited state can be excited in three dimensions of space. The excitation of different angles formed the basic particles with different excitation: vacuum angle is 0 degrees ,forming anti- neutrinos \( \bar{\nu}_e, \bar{\nu}_\mu, \bar{\nu}_\tau \); vacuum (clockwise) angle of
excitation is $\frac{\pi}{6}$, form d, s, b quark; vacuum (clockwise) angle of excitation is $\frac{4\pi}{3}$, form $e^+, \mu^+, \tau^+$ lepton; vacuum (clockwise) angle of excitation is $\frac{\pi}{6}$, form t, u, c quark; vacuum (clockwise) angle of excitation is $\frac{3\pi}{2}$, form $e^-, \mu^-, \tau^-$ lepton (see figure 4).

![Figure 4. Vacuum excited state.](image)

10. Rate equation of G mass field tensor [5]
Einstein’s general relativity is based on Riemann space, and Riemannian connections in Riemannian spaces only consider symmetric connections. It is true that asymmetric connections are not considered [6]. That is, Einstein’s gravitation theory is a gravitation theory with only curvature and no torsion. So Einstein’s theory of gravity is incomplete.

Following Complex gravitational equation, have:

$$\ddot{R}_{uv} + i\dot{R}_{uv} = -4\pi G T \left[1 - \frac{v^2}{c^2} + iT \frac{4\pi G v}{c}\right]$$

(43)

The first item on the left side of the equation reflects space-time curvature, and the second item reflects torsion. Besides the first item on the right side stands for real energy-momentum tensor, which is the cause for space-time curvature by the effect of gravitational force on particle to make it accelerate or decelerate? In addition, the second item on the right side stands for virtual energy-momentum tensor, which is the cause for space-time torsion by producing Coriolis’ force to make particle rotate, in addition as s source of dark energy and dark matter and stands for the space-time torsion.

The equation suggests that: moving speed of an object has an effect on intensity of gravitational force, which would change space-time torsion. When speed is equal to zero, the absolute value of gravitational force is maximum, which means a larger space-time curvature, while torsion is equal to zero. As the object starts to move, real mass as well as gravitational force begins to decrease, in the meanwhile the space-time torsion decreases but torsion increases. When speed approaches to light level, mass is equal to zero so gravitational force exerted on the object is equal to zero, which leads to the space-time curvature being equal to zero, while torsion has an maximum absolute value of $k|T_{uv}|$.

When the speed exceeds light level, the sign symbol of time item and space item will make exchange, that is to say, time item turns into space item, while space turns into time item.

11. G mass equation of G complex space-time tensor
This equation is G virtual space tensor mass equation.
Note: When rest mass $M$ is equal to zero, which means that the real gravitational force is zero leading to the space-time curvature being equal to zero. Under this condition, both Coriolis’ force and torsion are nonzero, that is $-4\pi GT$. When $\frac{M}{c^2} = \frac{R^2}{\hbar G}$, gravitational force exerted on the object reaches the limit, and absolute value of space-time curvature reaches maximum level, while torsion is equal to zero.

$$\bar{R}_{uv} + i\bar{R}_{uv} = 4\pi T \frac{\hbar G^2 M}{R^2 c^2} - i4\pi TG \sqrt{1 - \frac{\hbar^2 G^2 M^2}{R^2 c^4}}$$

(44)

12. G mass field theory’s application

12.1. Ji Hao’s calorimetry method for verifying relativity mass-velocity relation experiment

Experiment content:

Use linear accelerator beam output, the energy and strength of beam are controlled by instrument. The flow strength in the experiment is 1.26A; the energy of six energy segment is 1.6Mev, 6Mev, 8Mev, 10Mev, 12Mev, 15Mev respectively (The speed of 1.6Mev electron is 0.970c, and the speed of 15Mev electron is 0.999c according to the relativistic mass-velocity formula and the formula of mass-energy), the pulse width is 5ns, frequency is 5Hz, and the electron beam bombardment of the target is 120s; thus the received charge of target is $3.78 \times 10^{-6}$ (Coulomb); the total number of received electrons is $2.32 \times 10^{13}$ (unit). The lead used in 70 experiment weights 70g, every 1 degree increased, the needed energy is $0.031 \times 70 \times 4.18 = 9.0$ J. CENTER305 thermocouple thermometer automatically measure and record temperature, a resolution of 0.1 degrees Celsius, the error of plus or minus 0.1 degrees Celsius, which is enough to verify the accuracy of Theory of Relativity. Theoretical and experimental values of the energy and the temperature are as follows: The measured values of temperature that the electrons causing leads to rise are 0.97, 1.0, 1.03, 1.03, 1.03, 1.03 degrees Celsius. And the theoretical calculated value by using the theory of relativity is: 0.67, 2.52, 3.36, 4.20, 5.03, 6.29 degrees Celsius. There is large deviation between the theory values and actual values.

12.2. Experiment of movement law of Ji Hao’s different energy electron in a uniform magnetic field

Experiment content

The electron beam of 4Mev, 6Mev, 9Mev, 12Mev, 16Mev, 20Mev (The corresponding velocity calculated by the theory of relativity calculated is 0.9918c, 9.9969c, 0.9986c, 0.9992c, 0.9995c, 0.9997c respectively) from Varian 2300c/d accelerator, and the electron beam through the 10cm thick lead combination of collimator vertical shot into the 0.1210t i uniform magnetic field. The relativistic calculations of the radius of the electron beam within a magnetic field are 10.94cm, 16.41cm, 24.62cm, 32.82cm, 43.76cm and 54.70cm respectively. However, the results find that the radius of the above energy electrons in a magnetic field are almost all 18 cm, and the track is almost the same circle.

12.3. Current disposals of the divergence problem

At present, there have always been two major serious problems in area of quantum field theory. First, similar fundamental divergence problems occur when doing further high-order approximate calculations; second, the perturbation theory doesn’t work on strong interaction and this account for big deviation. The two problems have severely restricted the development of the quantum field theory [7].

It has been found that the infinity appeared in quantum electrodynamics regarding physical effect only shows in two aspects: one is the change of electronic self-energy which is electronic static quality change (see figure 5); another is the change of electron charge, namely the change of interacting constants between electrons and electromagnetic field. (see figure 6)
The renormalization theory holds that the quality of the observed electrons from the experiment is the total mass of the electron. Through the experiment, it’s not distinguishable which part is the inherent quality of the electron, which part is the electromagnetic quality of the electron (Self-energy of electrons generated due to the interaction with electromagnetic fields). Therefore, theoretically, we should combine the inherent quality of the electron and the electromagnetic quality to as the quality of the observed electron. Even if the electromagnetic mass of the electron is infinite, we should also assume that it is combined with the inherent mass of the electron and is equal to the finite electron mass observed by the experiment.

\[ m_{\text{exp}} = m + \delta m \]  
(45)

\( m_{\text{exp}} \) is the electron mass from the experiment; \( \delta m \) is the quality derived from the interaction between electron and electromagnetic field, also known as the electromagnetic mass; \( m \) is the theoretical mass of electron.)

In the same way, the renormalization theory holds that the electron charge from the experiment is all the charge of the electron. The experiment does not distinguish which part is the intrinsic charge of the electron, which part is the additional charge due to the effect of vacuum polarization. Therefore, theoretically, we should combine the intrinsic charge of the electron and the additional charge generated by the vacuum polarization as the charge of the observed electron. Even if the additional charges caused by vacuum polarization change infinitely, we still should assume that the total of the inherent electronic charge and vacuum polarization charge equals to the limit electron charge observed in the experiment. That is:

\[ q_{\text{exp}} = q + \delta q \]  
(46)

\( q_{\text{exp}} \) is the electron quality by experiment; \( \delta q \) the quality derived from the interaction between electron and electromagnetic field, also known as the electromagnetic mass; \( q \) is the theoretical mass of electron.)

The above is current interpretation of the theory of renormalization.

We know that quantum electrodynamics is the most mature, the most perfect, the most accurate subject in quantum field theory. The calculated values in the 7 decimal place are in good agreement with the experimental data. This implies that the theory of renormalization reflects the laws of the objective substance truly (or partially truly).

12.4. Agreement with existing and fundamental solution to the divergence problem in quantum field theory by G super complex space-time theory

According to the G super complex space-time theory, the electron complex mass is:

\[ m_e = m_r + im_i = m \sqrt{\left(1 - \frac{V^2}{c^2}\right) - i \frac{V}{c}} \]  
(47)

From the above equation, the real part of the complex mass is equivalent to the inherent quality of the electron, and the imaginary part is equivalent to the electromagnetic quality.

As the substance described in the quantum field theory is the one moving in a high speed, so when the speed of the substance is close to the speed of light, the real (inherent) mass of the electron will tend to be zero; the virtual (electromagnetic) quality is not infinite, but tends to be \(-i|m|\) (the
imaginary reflects the system as opposed to real, it is invisible to us but it does exist). $-i|m|$ is a constant. That is:

$$|m| = \sqrt{m_{re}^2 + m_{im}^2}$$  \hspace{1cm} (48)

However, the virtual (dynamic or electromagnetic) quality $m_{ex}$ cannot be measured, then how to get the mode quality of $|m|$?

If the real parts in (47) are equal:

$$m_{er} = |m|\sqrt{1 - \frac{v_r^2}{c^2}}$$  \hspace{1cm} (49)

If $v_r = 0$, then $m_{er} = |m|$

Therefore, through the experimental method, the electronic movement speed tends to be zero when the electronic static (real) quality is the quality of the electronic model.

In a similar way:

$$q = q_r + iq_s = |q|\left(\sqrt{1 - \frac{v_r^2}{c^2}} - i\frac{v_r}{c}\right)$$  \hspace{1cm} (50)

In the above equation, the real part of the complex electric charge is equivalent to the intrinsic charge of the electron, and the imaginary part is equivalent to the additional charge of the vacuum polarization. As the substance described in the quantum field theory is the one moving in a high speed, when the speed of the substance is close to the speed of light, the real (inherent) mass of the electron will tend to be zero; the virtual (electromagnetic) quality is not infinite, but tends to be $-i|q|$ (the imaginary reflects the system as opposed to real, it is invisible to us but it does exist). $-i|q|$ is a constant. That is:

![Figure 6. Electron self-energy.](image)

$$|q| = \sqrt{q_r^2 + q_s^2}$$  \hspace{1cm} (51)

However, the virtual (vacuum polarization) charge $q_s$ is not measured, then how to get the model of the charge $|q|$?

If the real parts in (50) equation is equal:

$$q_r = |q|\sqrt{1 - \frac{v_r^2}{c^2}}$$  \hspace{1cm} (52)

If $v_r = 0$, then $q_r = |q|$

So, through the experimental method, the analog value of the electron’s charge is the electron’s static (real) charge when the electron’s movement speed tends to be zero.
By extension, the divergence problem will have been solved by taking the integral model of all substances’ quality, charge and other physical quantity values in the integration in the quantum field theory.

It can be seen that the renormalization theory coincide with G complex space-time theory. And it can be expected that the calculating result of G super complex space-time theory will be in good agreement to the experimental data so that the divergence problem in quantum field theory is resolved fundamentally.

13. Conclusions

All physical quantities in the natural world can be expressed by complex numbers, in which the real part and virtual part together form an entity of contradiction. In detail, the real part is not only opposite but also interlinked to the virtual part and they can achieve mutual transformation. In a complex mass, the real part (real mass) embodies particle property (fermion) of a substance, while the virtual part (virtual mass) embodies the wave property (boson). Furthermore, the virtual property and entity property of mass lay a foundation for the theory of wave-particle duality. In addition, virtual substance is a main source to produce dark energy. The real part presents with a Riemann geometric space when expanded, while the virtual part presents with a Roche geometric space (speed space) when expanded. Roche space takes speed as radius and its limited radius is the speed of light. We believe that the natural world itself exists in the form of complex essential in a deeper dense. Neutrinos are magnetic monopole.

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