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G Complex Mass Theory

Guan Yiying [1] Guan Tianyu [2]

[1] No. 71 Diantan Road, Harbin 150030 [2] University of Toronto M5S2E8
guanyiying@163.com

Abstract: 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 the particle (fermion) property of a substance, while the virtual part (virtual mass) embodies the wave (boson) property. 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 matter. The real part presents with a Riemann geometric space when expanded, which reflects the curvature property of the space-time, while the virtual part presents with a Roche geometric space when expanded, which reflects the torsion property of the space-time. Roche space takes speed as radius and its limited radius is the speed of light.
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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 twistor theory in recent years with an attempt to use quantization on an overall level.

In this paper, the first standardized transformation $\psi \to \psi e^{i\theta}$ 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

As mentioned above, complex mass can be divided into two parts: real part (real mass) and virtual mass (virtual mass). Also, we call real mass as rest mass and virtual mass as dynamic mass.

$$\hat{m} = m_r + i m_x = |m|(\cos\theta + i\sin\theta) = |m|\sqrt{1-\frac{v_r^2}{c^2}} - i|m|\frac{v_r}{c} \quad (2.1)$$

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.

Make the real part and virtual part corresponding equal to each other, coming that:

$$m_r = |m|\sqrt{1-\frac{v_r^2}{c^2}} \quad (2.2)$$

$$m_x = |m|(-\frac{v_s}{c}) = -|m| \times \frac{v_r}{c}$$

(2.3)

Therefore, we have: $m = m_r - i\frac{p_r}{c}$

(2.4)

and the corresponding conjugate complex to m is:

$$m^* = m_r + i\frac{p_r}{c}$$

(2.5)

Then m multiplied by itself is:

$$m^2 = (m, m^*) = m_r^2 + \frac{(|m| \times v_r)^2}{c^2}$$

(2.6)

$|m|$, as module of particle mass (the gross mass), is an invariant, while m_r and m_x vary by v_r. That is to say, when v_r =0, $m_r = |m|; m_x = 0$, and when $v_r = c$, $m_r = 0; m_x = -|m|$. 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 Field strength of G Complex Mass (Mass Acceleration)

For $\beta = \pi + \theta$ (see Fig 1), we get:

$$\hat{E} = E_r + iE_x = |E|(\cos\beta + i\sin\beta) = -|a|(\cos\theta + i\sin\theta)$$

$$= -|a|\sqrt{1 - \frac{v_r^2}{c^2}} + i|a| \times \frac{v_r}{c}$$

(3.1)

Hence, $E_r = -|E|\cos\theta = -|a|\sqrt{1 - \frac{v_r^2}{c^2}} = -E_j = -a_r$

(3.2)

For

$$E_x = -|E|\sin\theta = |a| \times \frac{v_r}{c} = r\omega^2 \times \frac{v_r}{c} = r\omega \times \frac{cv_r}{rc} = \omega \times v_r$$

(3.3)

Apply (3.2) and (3.3) to (3.1), we can get that:

$$E = a = -a_r + i|a| \times \frac{v_r}{c} = -a_r + i\omega \times v_r \quad (3.4)$$

(In this equation $\omega = \frac{|a|}{c}$ stands for induction intensity of virtual mass field (dynamic mass), and $E_d = \omega \times v_r$ stands for field-strength of virtual mass (dynamic mass))

Also we know that:

$$E^2 = E_r^2 + E_x^2$$

(3.5)

Where, $v_r = 0$; $E_r = |E|$; $E_x = 0$

$v_r = c$; $E_r = 0$; $E_x = -|E|$

Note: When object moving speed is equal to zero, the field strength of real mass (rest mass) is maximum, while the virtual (dynamic) mass is equal to zero. As the speed approaches to lighting level, the real field-strength decreases to zero, and the virtual field-strength is presented with negative form with the maximum absolute value. This indicates that a changing real field-strength can lead to formation of changing virtual field-strength, and in turn a changing virtual field-strength can lead to the formation of changing real field-strength, therefore there are two kinds of electric field in the universe. The wave direction of mass wave (gravitational wave) and the two kinds of field mentioned above are mutual orthogonal, so we come to a conclusion that mass wave is a transverse wave.

4 G Complex Mass Force

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.

Based on Newton's law of gravitation:

$$F = G\frac{m_1 m_2}{s^2} \quad (4.1)$$

Deal with the above equation to make it standardized (i.e. to write in a plurality), we get:

$$\hat{F} = |F|e^{i\beta} = \left|\frac{GMm}{s^2}\right|e^{i\beta}$$

(4.2)

For $\beta=\pi+\theta$, (see Fig 1)

So we conclude that:

$$F+iF=-G\left|\frac{m_1m_2}{s^2}\right|(\cos\theta+i\sin\theta)$$

(4.3)

And above expression is G complex mass force equation

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

$$F_r+iF_x=-G\left|\frac{m_1m_2}{s^2}\right|\left(\sqrt{1-\frac{v_r^2}{c^2}}-i\frac{v_r}{c}\right)$$

(4.4)

(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

$$F_r=-G\left|\frac{m_1m_2}{s^2}\right|\sqrt{1-\frac{v_r^2}{c^2}}$$

(4.5)

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

And the virtual part is:

$$F_x=G\frac{|m_1m_2|\times v_r}{s^2c}=\frac{a}{c}m_2\times \mathrm{v_r}=\frac{s\omega^2}{c}\mathrm{m_2}\times \mathrm{v_r}=$$

(4.6)

(ω stands for rotation angular frequency)

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

If $v_r=0$ then $F_r=-m_{2j}g$; $F_x=0$

If $v_r=c$ then $F_r=0$; $F_x=\mathrm{mv_r}\times\omega$

If $v_r>c$, then F_r changes into an 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. Further when the speed exceeds to light level, the real mass force existed in real space will change into gravitational repulsion. 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. (The reason is that the status of the photon is no longer affected by rest mass force so that speed is kept steady, but dynamic (virtual) mass force is still there and works, therefore the moving direction is changed). 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.

And so:

$$F^2=(F,F^*)=F_r^2+F_x^2=\left(G\frac{m_1m_{2r}}{s^2}\right)^2+(m\omega\times v_r)^2$$

(4.7)

The equation can be also expressed as:

$$F^2=(\mathrm{m_2g})^2+(\mathrm{m_2}\omega\times\mathrm{v_r})^2$$

(4.8)

The expressions above shall be G complex mass force equation.

If two particles stay close enough, based on the uncertainty principle, we know that its momentum will be great enough, in another word the moving speed will approach to light level, so we may get:

$$F_r=-G\left|\frac{m_1m_2}{s^2}\right|\sqrt{1-\frac{v_r^2}{c^2}}=\frac{0}{0}=k$$

(4.9)

Introduction of complex mass force clears up the misunderstanding that gravity always keeps infinite.

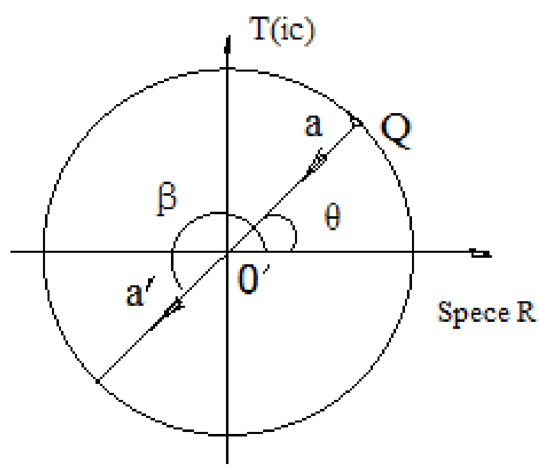

Fig 1 G Complex Space-time Acceleration

5 Classic Equation for G Mass Field [2]

Draw analogy with Maxwell's equations, we have the following G classic mass field equations:

$$\nabla \bullet \varepsilon E_r = \rho_0$$
$$\nabla \bullet \mu E_x = 0$$
$$\nabla \times E_r = -\frac{\mu \partial E_x}{c \partial t}$$
$$\nabla \times E_x = j_0 + \frac{\varepsilon \partial E_r}{c \partial t}$$

(5.1)

(In this equation, ε, μ respectively stands for constant of non-vacuum real mass field and non-vacuum virtual mass field, and E_r stands for field strength of real (rest) mass, E_x stands for the field strength of virtual (dynamic) mass. For this equation, the real mass field expression and virtual mass field are not symmetrical essentially, but if we add dot product and cross product of real mass field and virtual mass field respectively, it turns out that they are basically symmetrical, which can be written as:

$$\hat{E}_r = \nabla \bullet \varepsilon E_r + \nabla \times E_r = \rho_0 - \frac{\mu \partial E_x}{c \partial t}$$

(5.2)

$$\hat{E}_x = \nabla \bullet \mu E_x + \nabla \times E_x = j_0 + \frac{\varepsilon \partial E_r}{c \partial t}$$

(5.3)

Express substance field in the form of time-Harmonic complex number, and the corresponding time derivative is:

$$\frac{\partial E(r,t)}{\partial t} = \frac{\partial}{\partial t}[E(r)e^{-i\omega t}] = -i\omega E(r,t)$$

(5.4)

Therefore, we have derivative operator: $\frac{\partial}{\partial t} \to i\omega$

All derivative operators: $\frac{\partial}{\partial t} \to i\omega$

(5.5)

Then, we have: $\nabla \bullet \varepsilon E_r = \rho_0$

(5.6)

$$\nabla \bullet \mu E_x = 0$$

(5.7)

$$\nabla \times E_r = i\omega \mu E_x$$

(5.8)

$$\nabla \times E_x = j_0 - i\omega \varepsilon E_r$$

(5.9)

Add (5.6) to (5.8), we can get complex vector of rest mass field:

$$\hat{E}_r = \nabla \bullet \varepsilon E_r + \nabla \times E_r = \rho_0 + i\omega \mu E_x$$

(5.10)

Add (5.7) to (5.9), we can get complex vector of dynamic mass field:

$$\hat{E}_x = \nabla \bullet \mu E_x + \nabla \times E_x = j_0 - i\omega \varepsilon E_r$$

(5.11)

(5.9) and (5.10) can be considered as expression forms in complex number for G classic mass field equations: According to above equation, we may say that the curl of a rest mass field is essentially a dynamic mass field, and the curl of a dynamic mass field is essentially a rest mass field. Further, we can see j_0 as the source of dynamic mass field.

Herein, we define G as an operator: $\lhd = \nabla \bullet + \nabla \times$

(5.12)

($\lhd$ reads as left triangle, ∇ is Laplace operator)

Through this operator, a vector can be turned into a complex vector.

Take rest electrostatic field for example:

$$\lhd E_r = \nabla \bullet E_r + \nabla \times E_r$$

(5.13)

In this equation: $k = \varepsilon$

6 G Mass Field Tensor

G mass field tensor is defined as follows:

$$M_{uv} = \begin{bmatrix} 0 & E_{r1} & E_{r2} & E_{r3} \\ -E_{r1} & 0 & -\mu E_{x3} & E_{x2} \\ -E_{r2} & \mu E_{x3} & 0 & -\mu E_{x1} \\ -E_{r3} & -\mu E_{x2} & \mu E_{x1} & 0 \end{bmatrix} = -M_{uv}$$

(6.1)

Then: $divM_{uv} = \nabla \bullet M_{uv} = j_u$

(6.2)

($j_u = \rho_0 U_u$, ρ_0 standing for density of rest mass)

$$curlM_{uv} = \nabla \times M_{uv} = 0$$

(6.3)

Or equivalently:

$$\lhd M_{uv} = \nabla \bullet M_{uv} + \nabla \times M_{uv} = j_u \qquad (6.4)$$

The expressions above are G mass tensor equations.

7 Rate Equation of G Mass Field Tensor [4]

Energy-momentum tensor is:

$$T_{uv} = \begin{bmatrix} \omega & s_1/c & s_2/c & s_3/c \\ cg_1 & T_{11} & T_{12} & T_{13} \\ cg_2 & T_{21} & T_{22} & T_{23} \\ cg_3 & T_{31} & T_{32} & T_{33} \end{bmatrix}$$

(7.1)

(ω is energy density, S_j is energy flux density, g_i is the vector part of momentum density, T_{ij} is three-dimension stress tensor)

$-4\pi G T_{uv} t^a t^b \delta V$, Newton expected value, which stands for the acceleration of volume change resulted from changes of matter density is equivalent to acceleration of volume change resulted from space-time curvature change, [5] $R_{ab} t^a t^b \delta V$,

Hence: $$R_{uv} = -4\pi G T_{uv}$$

(7.2)

Transform the equation (i.e. to write in a plurality), we can get the G complex time-space tensor equation:

$$|R_{uv}| e^{i\theta} = -4\pi G |T_{uv}| e^{i\theta}$$

(7.3)

To be expressed in triangular form

: $$R_{uv} + iR_{uv} = -4\pi G |T_{uv}| (\cos\theta + i\sin\theta)$$

(7.4)

(R_{uv} is the real part of Liqi tensor and R_{uv} is the virtual part, while T_{uv} is virtual part of energy-momentum tensor and θ is time-space angle)

Based on G complex spacetime theory, we can get:

$\cos\theta = \sqrt{1 - \frac{v_r^2}{c^2}}$, $\sin\theta = -\frac{v_r}{c}$, then apply to

(7.4)

Let $|T_{uv}| = T$ (T represents the trace of energy-momentum tensor, which is a certain constant in the whole space-time), we can get rate equation of G complex space-time tensor, that is:

$$R_{uv} + iR_{uv} = -4\pi G T \sqrt{1 - \frac{v_r^2}{c^2}} + iT \frac{4\pi G v_r}{c}$$

(7.5)

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 spacetime torsion.

From the equation, we can get the real part [6]:

$$R_{uv} = -4\pi G T \sqrt{1 - \frac{v_r^2}{c^2}} ;$$

(7.6)

This equation is rate equation of G virtual space-time tensor.

And make the virtual parts corresponding equal to each other, we can get rate equation of G virtual space-time tensor, that is:

$$R_{uv} = 4\pi G T \frac{v_r}{c}$$

(7.7)

The equation suggests that: moving speed of an object has an effect on intensity of gravitational force, which would change spacetime 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.

8 G Mass Equation of G Complex Space-time Tensor

According to G complex space-time theory:

For

$$\beta = \pi + \theta$$

Or equivalently:

$$a = a_r + ia_x = |a|(\cos\beta + i\sin\beta) = \frac{c^2}{r}[\cos(\pi+\theta) + i\sin(\pi+\theta)]$$

$$= -\frac{c^2}{r}(\cos\theta + i\sin\theta)$$

(8.1)

Make the real parts corresponding equal to each other:

$$a_r = -\omega^2 |r| \cos\theta = -\frac{c^2}{|r|}\cos\theta$$

Or equivalently: $$\cos\theta = -\frac{a_r r}{c^2}$$

(8.2)

$$\sin\theta = \sqrt{1 - \frac{a_r^2 |r^2|}{c^4}}$$

(8.3)

Based on the principle of equivalence, we get:

$$a_r = g = G\frac{M_r}{r^2}$$

(8.4)

(g stands for acceleration of gravity, G is gravitational constant and M_r represents real mass)

Therefore, we have: $\cos\theta = -\frac{GM_r}{rc^2}$

(8.5)

Or equivalently:

$$\sin\theta = \sqrt{1-\cos^2\theta} = \sqrt{1-\frac{G^2M_r^2}{r^2c^4}} \quad (8.6)$$

Apply (8.5) and (8.6) to (7.4), we can get mass equation for G complex space tensor, that is:

$$\tilde{R}_{uv} + i\tilde{R}_{uv} = -kT\frac{GM_r}{rc^2} + ikT\sqrt{1-\frac{G^2M_r^2}{r^2c^4}}$$

(8.7)

Let the real parts corresponding equal to each other, we can get:

$$\tilde{R}_{uv} = -kT\frac{GM_r}{rc^2}$$

(8.8)

This equation is G real space tensor mass equation.

Make the virtual parts corresponding equal to each other, we can get:

$$\tilde{R}_{uv} = -iT\sqrt{1-\frac{G^2M_r^2}{r^2c^4}}$$

(8.9)

This equation is G virtual space tensor mass equation.

Note: When rest mass M_r is equal to zero, which means that the real gravitational force is at minimum leading to the space-time curvature being equal to zero. Under this condition, both Coriolis' force and torsion are nonzero, that is $-kT$. When $\mathrm{M} = \pm\frac{\mathrm{rc}}{\mathrm{G}}$, gravitational force exerted on the object reaches the limit, and absolute value of space-time torsion reaches maximum level, while torsion is equal to zero.

9 G Mass Field Metric

Standardize the equation of time-space interval, we can get: $d\tilde{s} = |ds|e^{i\theta} = |ds|(\cos\theta + i\sin\theta)$

(9.1)

Square of above equation: $d\tilde{s}^2 = |ds|^2[(2\cos^2\theta - 1) + i2\sin\theta\cos\theta]$

(9.2)

And we get G complex line element expression, based on G complex space-time theory, we can get:

$$ds^2 + ids^2 = |-c^2dt^2 + dr^2|[(1-\frac{2v_r^2}{c^2}) - i2\frac{v_r}{c}\sqrt{1-\frac{v_r^2}{c^2}}]$$

(9.3)

This is G complex space-time speed line element equation. To make the real parts corresponding equal to each other, we can get:

$$ds^2 = -c^2(1-\frac{2v_r^2}{c^2})dt^2 + (1-\frac{2v_r^2}{c^2})dr^2$$

(9.4)

Above equation shows the G real space speed line element.

G real space speed metric is:

$$\tilde{g}_{uv} = \begin{bmatrix} -c^2(1-\frac{2v_r^2}{c^2}) & 0 \\ 0 & 1-\frac{2v_r^2}{c^2} \end{bmatrix}$$

(9.5)

When the speed is equal to zero,

$$\tilde{g}_{uv} = \begin{bmatrix} -c^2 & 0 \\ 0 & 1 \end{bmatrix}$$

(9.6)

When the speed reaches light level:

$$\tilde{g}_{uv} = \begin{bmatrix} c^2 & 0 \\ 0 & -1 \end{bmatrix}$$

(9.7)

Above equation shows that the relation between metric and space-time rate is parabolic, in detail when the speed is equal to zero, the space metric is at standard level with maximum value. During moving, the metric will change to non-standard status. In a word, a changing speed makes difference to the metric, and while the speed is in light level, the metric will be a vacuum. As shown in G complex space-time metric speed Fig.

Make virtual parts in equation (9.3) equal to each other, we can get G virtual space-time speed line element:

$$ds^2 = |-c^2dt^2 + dr^2|[-2\frac{v_r}{c}\sqrt{1-\frac{v_r^2}{c^2}}]$$

(9.8)

$$ds^2 = 2\frac{v_r}{c}\sqrt{1-\frac{v_r^2}{c^2}}]c^2dt^2 - 2\frac{v_r}{c}\sqrt{1-\frac{v_r^2}{c^2}}dr^2$$

(9.9)

Above equation shows G virtual space speed line element.
And G virtual space speed metric is:

$$g_{uv}=\begin{bmatrix} 2c^2\frac{v_r}{c}\sqrt{1-\frac{v_r^2}{c^2}} & 0 \\ 0 & -2\frac{v_r}{c}\sqrt{1-\frac{v_r^2}{c^2}} \end{bmatrix}$$

(9.10)
G complex mass line element is:

$$ds^2+ids^2=\left|-c^2dt^2+dr^2\right|\{(2\cos^2\theta-1)+i2\mathrm{si}$$

(9.11)
Apply (8.5) and (8.6) to (9.9), we have:

$$ds^2+ids^2=\left|-c^2dt^2+dr^2\right|\{(2\frac{G^2M^2}{r^2c^4}-1)-i2\frac{GM}{rc^2}\sqrt{1-\frac{G^2M^2}{r^2c^4}}\}$$

(9.12)
Above equation shows G complex space-time mass line element.
Make the real parts corresponding equal to each other, we can get:

$$ds^2=-c^2\{\frac{2G^2M^2}{r^2c^4}-1\}dt+(\frac{2G^2M^2}{r^2c^4}-1)dr$$

(9.13)
G real space-time mass metric is:

$$\hat{g}_{uv}=\begin{bmatrix} -c^2[2(\frac{GM}{rc^2})^2-1] & 0 \\ 0 & 2(\frac{GM}{rc^2})^2-1 \end{bmatrix}$$

(9.14)
G virtual mass line element is

$$:ds^2=\left|-c^2dt^2+dr^2\right|\{-i2\frac{GM}{rc^2}\sqrt{1-\frac{G^2M^2}{r^2c^4}}\}$$

(9.15)
G virtual space-time mass metric is:

$$\hat{g}_{uv}=\begin{bmatrix} \frac{2GM}{r}\sqrt{1-\frac{G^2M^2}{r^2c^4}} & 0 \\ 0 & -2\frac{GM}{rc^2}\sqrt{1-\frac{G^2M^2}{r^2c^4}} \end{bmatrix}$$

(9.16)
Note: When $M_r=0$, the real mass metric is

$$:\hat{g}_{uv}=\begin{bmatrix} c^2 & 0 \\ 0 & -1 \end{bmatrix}$$

(9.17)
When $M=\pm\frac{rc^2}{G}$, the real mass metric is

$$:\hat{g}_{uv}=\begin{bmatrix} -c^2 & 0 \\ 0 & 1 \end{bmatrix}$$

(9.18)

10 Relationships between Important Physical Quantities

10.1 Relationship between Charge and Acceleration

According to G complex space-time theory, we have:
For: $\beta=\pi+\theta$ (See Fig 1),
Therefore, we have:

$$a=a_r+ia_x=-\frac{c^2}{|r|}(\cos\theta+i\sin\theta)$$

(10.1.1)
(a stands for complex centripetal acceleration)
Make real part on the left side equal to the one on the right side:

$$a_r=-\frac{c^2}{|r|}\cos\theta \quad \text{i.e.} \quad \cos\theta=-\frac{a_r|r|}{c^2}$$

(10.1.2)
From trigonometric function, we get that:

$$\sin\theta=\sqrt{1-\frac{a_r^2|r^2|}{c^4}}$$

(10.1.3)
Provided that there is an electron-positron pair, the positron stays at origin point, while the electron stays at q point, then the force exerted on the electron in q point is in accordance with the acceleration direction shown in Fig 1.

$$q=q_r+iq_x=|q|e^{i\beta}=|q|(\cos\beta+i\sin\beta)=-|q|(\cos\theta+i\sin\theta)$$

(10.1.4)
(q stands for a complex charge)
Apply (10.1.2) and (10.1.3) to (10.1.4), we can get:

$$q_r+iq_x=-|q|(-\frac{a_r|r|}{c^2}+i\sqrt{1-\frac{a_r^2|r|^2}{c^4}})$$

(10.1.5)
Above expression is the G complex charge acceleration equation (short for GFDJ equation)
The real parts in above equation corresponding equal to each other, we can get:

$$q_r=|q|\frac{a_r|r|}{c^2}$$

(10.1.6)
Above expression is the G real charge acceleration equation (short for GSDJ equation)
Above equation shows that the module of both electric charge amount and distance is a constant for certain

object, which means that the ratio between charge amount and acceleration is a constant. And real charge (rest charge) is proportional to acceleration. (To some degree, electric charge is a mirror to its acceleration in the real space). When the projection of electron acceleration in real space-time (that is real acceleration) is a maximum negative value, then the charge amount is also in a maximum negative level. When the projection is equal to zero, then the amount of electron (real charge) is also equal to zero. Under this condition, the electron will turn into an electron neutrino with a traveling speed in light level.

For that reason, we can employ the figure (Fig 1) that is drawn to describe the centripetal acceleration to represent the property of charge in a same level.

Or equivalently: $$\frac{q_r}{a_r} = |q|\frac{|r|}{c^2} = k_j$$

(10.1.7)

In equation (10.1.5), make the virtual parts corresponding equal to each other, we can get:

$$q_x = \sqrt{1 - \frac{a_r^2 |r|^2}{c^4}}$$

(10.1.8)

and this equation is G virtual charge acceleration equation (short for GXDJ equation)

If it is a positron that stays at q point, then the equation (10.1.4) may be like this:

$$q = q_r + iq_x = |q|(\cos\theta + i\sin\theta)$$

(10.1.9)

Apply (10.1.2) and (10.1.3) to (10.1.9), we can get:

$$q_r + iq_x = |q|\left(-\frac{a_r|r|}{c^2} + i\sqrt{1 - \frac{a_r^2|r|^2}{c^4}}\right)$$

(10.1.10)

Make real part on the left equal to the one on the right, we can get:

$$q_r = -|q|\frac{a_r|r|}{c^2}$$

(10.1.11)

The equation above is different to the equation where the charge at point Q is negative by a minus sign, which indicates that where acceleration reaches the maximum negative value, the mount of positive charge reaches peak.

10.2 Relationship between Charge and Mass:

Based on G complex space-time theory:

And principal of equivalence:

Transform gravitational potential energy into a plurality number:

$$|g|e^{i\theta} = \left|\frac{GM}{r^2}\right|e^{i\theta}$$

(10.2.1)

Above formula is G complex gravity potential equation, which can be also written as:

$$g_r + ig_x = -\left|\frac{GM}{r^2}\right|(\cos\theta + i\sin\theta)$$

(10.2.2)

Make the real parts in the equation corresponding equal to each other, we can get:

$$g_r = -\left|\frac{GM}{r^2}\right|\cos\theta = -\frac{GM_r}{|r^2|}$$

(10.2.3)

Based on the principle of equivalence, we have:

$$g_r = a_r$$

(10.2.4)

Apply (10.2.3) and (10.2.4) to (10.1.2), we can get:

$$\cos\theta = -\frac{GM_r}{|r|c^2}$$

(10.2.5)

Based on the trigonometric relations, we know:

$$\sin\theta = \sqrt{1-\cos^2\theta} = \sqrt{1 - \frac{G^2M_r^2}{|r|^2c^4}}$$

(10.2.6)

Apply (10.2.5) and (10.2.6) to (10.1.4), we can get:

$$q_r + iq_x = -|q|\left(-\frac{GM_r}{|r|c^2} + i\sqrt{1 - \frac{G^2M_r^2}{|r^2|c^4}}\right)$$

(10.2.7)

That is G complex charge mass equation (short for GFDZ equation)

and make the real part corresponding equal to each other, we can get:

$$q_r = \frac{|q|G}{|r|c^2}M_r$$

(10.2.8)

Above equation shows that since the module of charge amount and distance is a constant for a certain particle, which means that rest mass is proportional to rest charge amount. Supposed that gravitational constant is a constant, then the ratio between rest charge amount and its rest mass is a constant. When rest mass is equal to zero, the static charge amount is zero. And if the rest mass is equal to zero, the photon will definitely be uncharged.

which can be written as: $\frac{q_r}{M_r} = |q| \frac{G}{|r|c^2} = k_z$

(10.2.9)

($k_z = 1.758820150\times 10^{11} c/kg$, $|r|$ stands for Guan Yiying radium,)

And (10.2.9) shows that to some extent, charge amount and mass is equivalent, which is a root cause for the similarity presentation of Coulomb Law and Gravity Law.

11 Isospin

11.1 G Isospin

When G particle rotates in a complex spacetime, the G isospin will come into being. This isospin satisfy the SU (4), and the isospin quantity is j = 3/2 among which the third component has 2j+1 states, that is -3/2, -1/2, 1/2, 3/2. The four states are respectively displayed as follows:

$$G_{jn} \equiv \begin{pmatrix} \varphi_{1n} \\ \varphi_{2n} \\ \varphi_{3n} \\ \varphi_{4n} \end{pmatrix} , \qquad \overset{*}{G}_{jn} \equiv \left(\overset{*}{\varphi}_{1n}, \overset{*}{\varphi}_{2n}, \overset{*}{\varphi}_{3n}, \overset{*}{\varphi}_{4n}\right)$$

(11.1.1)

(j=1, 2, 3, 4. The value of j is variable, which stands for a different angle between space and time. n=1, 2, 3, and variable n stands for a different grade. As shown in figure 2)

The third component of G isospin is:

The corresponding time-space angle to state $I_3 = -3/2$ is $\theta = -\pi$, and corresponding lepton is $\tau, \mu, e,$

The corresponding time-space angle to state $I_3 = -1/2$ is $\theta = \frac{\pi}{2}$, and corresponding neutrino is $\nu_\tau, \nu_\mu, \nu_e,$

The corresponding time-space angle to state $I_3 = 1/2$ is $\theta = \frac{2\pi}{6}$, and corresponding quark is d, s, b

The corresponding time-space angle to state $I_3 = 3/2$ is $\theta = -\frac{\pi}{6}$, and corresponding quark is u, c, t

G_{11}=d down quark, G_{12}=s strange quark, G_{13}=b bottom quark;

G_{21}= ν_e electron neutrino, G_{22}= neutrino, ν_μ G_{23}= ν_τ neutrino

G_{31}= e electron, G_{32}= μ lepton, G_{33}= τ lepton

G_{41}= u up quark, G_{42}= c charm quark, G_{43}= t top quark (See figure 2)

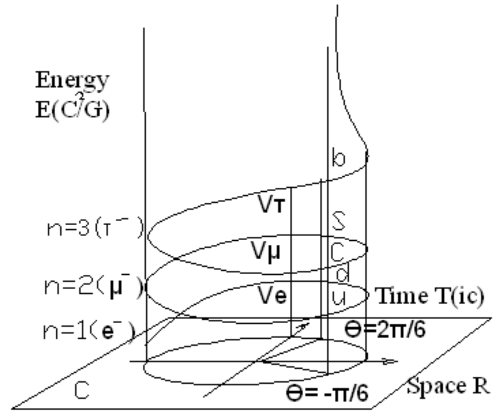

Fig 2 G Super complex spatiotemporal fiber bundle

11.2 Y Isospin

When Y particle rotates in a complex spacetime, the Y isospin will come into being. This isospin satisfy the YSU(5), and the isospin quantity is j=2 among which the third component has five states, that is -2, -1, 0, 1, 2, 2. The five states are respectively displayed as follows(as shown in figure 3):

$$Y_j \equiv \begin{pmatrix} \varphi_1 \\ \varphi_2 \\ \varphi_3 \\ \varphi_4 \\ \varphi_5 \end{pmatrix} , \qquad \overset{*}{Y}_j \equiv \left(\overset{*}{\varphi}_1, \overset{*}{\varphi}_2, \overset{*}{\varphi}_3, \overset{*}{\varphi}_4\right)$$

(11.2.1)

(j=1, 2, 3, 4, 5. Variable j stands for a different angle between space and time.)

The third component of Y isospin is:

When $I_3 = -2$, corresponding particle is commutator of strong interaction, gluon

When $I_3 = -1$, corresponding particle is commutator of weak interaction, W boson and Z boson.

When $I_3 = 0$, corresponding particle is Higgs boson.

When $I_3 = 1$, corresponding particle is commutator of electromagnetic action, photon.

When $I_3 = 2$, corresponding particle is commutator of gravitational force

11.3 G symmetry broken

When the symmetry G isospin breaking, G will divide into two two-dimensional symmetry isospin, that is electron- electron neutrino and quark-quark isospin.

11.3.1 Lepton-Neutrino isospin

$$\varphi_{dn} \equiv \begin{pmatrix} \varphi_{qn} \\ \varphi_{zn} \end{pmatrix}, \quad \overset{*}{\varphi}_{dn} \equiv \begin{pmatrix} \overset{*}{\varphi}_{qn}, \overset{*}{\varphi}_{zn} \end{pmatrix}$$

(11.3.1)

n=1, 2, 3. $\varphi_{q1}=e$ (electron), $\varphi_{q2}=\mu$ particle, $\varphi_{q3}=\tau$ particle,

$\varphi_{z1}=\nu_e$ (electron neutrino), $\varphi_{z2}=\nu_\mu$ (μ neutrino)'

$\varphi_{z3}=\nu_\tau$(τ neutrino)

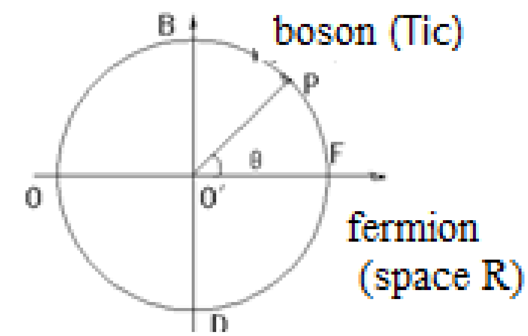

Fig 4 supersymmetric model

Isospin of lepton-neutrino is 1/2, and the third component has two states, that is $\pm\frac{1}{2}$

11.3.2 Quark and isospin.

$$\varphi_{kn} \equiv \begin{pmatrix} \varphi_{qn} \\ \varphi_{zn} \end{pmatrix}, \quad \overset{*}{\varphi}_{kn} \equiv \begin{pmatrix} \overset{*}{\varphi}_{qn}, \overset{*}{\varphi}_{zn} \end{pmatrix}$$

(11.3.2)

(n=1, 2, 3. $\varphi_{q1}=u$ (quark), $\varphi_{q2}=c$ (quark), $\varphi_{q3}=t$ (quark), $\varphi_{z1}=d$ (quark), $\varphi_{z2}=s$ (quark), $\varphi_{z3}=b$ (quark))

Isospin of quark is 1/2, and the third component has two states, that is $\pm\frac{1}{2}$

12 G Supersymmetry

Basic fermion and boson are particles coming from movement process of c Tai Jizi in two different states of motion. When basic fermion rotates $\frac{\pi}{2}$ in complex spacetime, it will convert into basic boson, and vice versa. As shown in figure 4.

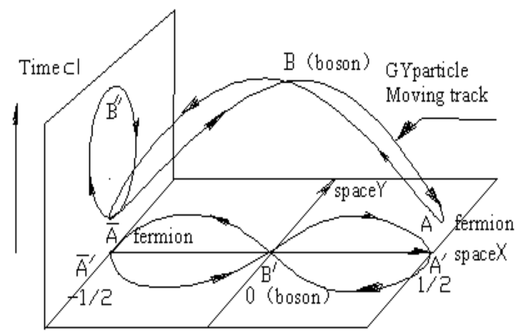

Fig 5 GY particle fiber bundle

$$\varphi_{cn} \equiv \begin{pmatrix} \varphi_{fn} \\ \varphi_{bn} \end{pmatrix}, \quad \overset{*}{\varphi}_{cn} \equiv \begin{pmatrix} \overset{*}{\varphi}_{fn}, \overset{*}{\varphi}_{bn} \end{pmatrix}$$

(12.1)

(n=1, 2, 3, respectively stands for one-three grade, and φ_{fn} stands for fermion and φ_{bn} stands for boson.)

and lagrangian density is:

$$\psi = \left\{ \frac{\partial \overset{*}{\varphi}_{cn}}{\partial x_\mu} \bullet \frac{\partial \varphi_{cn}}{\partial x_\mu} + m^2 \varphi_{cn} \overset{*}{\varphi}_{cn} \right\} \quad (12.2)$$

and the equation of motion is: $([\ ]-m^2)\psi=0$ (12.3)

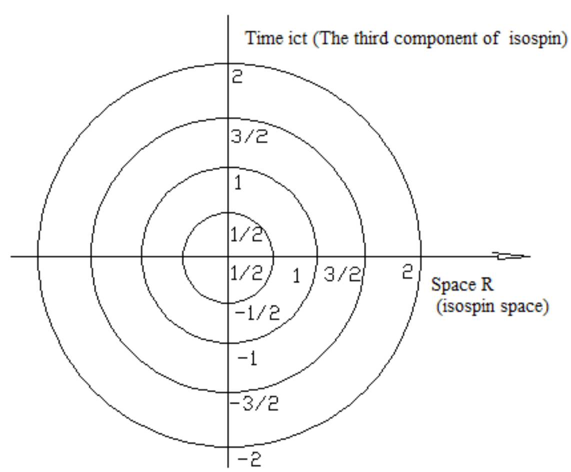

Fig 3 Isospin space

And conversed quantity (isospin) is

$$K=-i\int\frac{\partial\varphi}{\partial t}k\varphi\bullet dx \qquad (12.4)$$

(Components of K shall be K_1, K_2, K_3; components of k shall be k_1, k_2, k_3)
Figure 5 shows the feature of matter waves.
The isospin resulted from movement in complex spacetime satisfy SU (2), according to Liqun, we get[2]:

$$su(2)=\sigma_0\cos\frac{\theta}{2}+iT^{v}\sigma_v\sin\frac{\theta}{2}$$

(12.5)
(v=1, 2, 3. σ is Pauli spin matrix, θ is time-space angle, and is real three T^{v} -dimensional vector)
and:

$$\sigma_0=\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix};\ \sigma_1=\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix};\ \sigma_2=\begin{bmatrix}0 & -i\\ i & 0\end{bmatrix};\ \sigma_3=\begin{bmatrix}1 & 0\\ 0 & -1\end{bmatrix}$$
)

Since period of trigonometric function is 2π, so for the equation(12.1) when $\theta=4\pi$, it has completed a circle. When θ is equal to zero, the real part is 1, while virtual part is 0. When θ reaches to 2π, the real part is -1, and virtual part is zero, in this condition, real part doesn't return to the start state, while virtual keep the original state. When θ reaches to 4π, virtual part is zero and real part returns to 1. Therefore, we may conclude that in the equation (12.1), the real part represent the electrical property of fermion, while the virtual part represent the magnetic property and colour property of boson. (σ_0 forms the charge dimension, $\sigma_1,\sigma_2,\sigma_3$ are generators of SU(2), in the meanwhile, they are three dimensions of colour charge)

In principle, each fermion includes a boson, due to identical properties of boson in a whole circle the property of boson is covered. And for this reason, we call it G supersymmetry.
According to (12.1), we can get

$$su^2(2)=(\sigma_0\cos\frac{\theta}{2})^2+(T^{v}\sigma_v\sin\frac{\theta}{2})^2$$

(12.6)
Based on the theory of G super complex spacetime, we know that isospace is actually a complex spacetime, therefore, supersymmetry satisfy SU (2) group.
And its character is [4

$$]\ \chi^{(j)}(\alpha)=\sum_{m=-j}^{j}e^{im\alpha}=\frac{\sin\left(j+\frac{1}{2}\right)\alpha}{\sin(\alpha/2)}$$

(12.7)

(α stands for rotation angle around z axis in real three-dimensional space. j is isospin quantity, when j is a non-negative integer, the corresponding function embodies property of boson, and when j is a non-negative half integer, it presents the property of fermion)
to express as function is: [4]:

$$f_{jn}^{m}=\frac{u^{j+m}v^{j-m}}{[(j+m)!(j-m)!]^{1/2}}$$

(12.8)
(n stands for energy metabolism, n=1, 2, 3. j stands for isospin quantity and m is the third component of isospin quantity)
And the matrix element is: [4]:

$$D^{(j)}(a,b)_{m'}^{m}=\sum\frac{[(j+m)!(j-m)!(j+m')!(j-m')!]^{1/2}}{[(j+m-k)!k!(j-m'-k)!(m'-m+k)!]}$$
$$\times a^{j+m-k}(a^*)^{j-m'-k}b^k(-b^*)^{m'-m+k}$$

(12.9)

$$D^{(j)}(a,b)=\begin{cases}D^{(j)}(-a,-b),\ j=\text{non-negative integer(boson)}\\ -D^{(j)}(-a,-b),\ j=\text{non-negative half integer}(fermion)\end{cases}$$

(12.10)
When j is a non-negative integer, the two elements in SU (2) series is corresponding to the same representing matrix,
When j is a non-negative half integer, the representing matrix of SU (2) group $D^{(j)}(a,b)$ is one to one corresponding to elements.

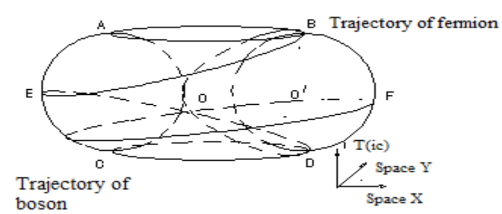

Fig 6 Three-dimensional model for G complex spacetime

The physical meaning is that: boson has two elements (positive particle and negative particle) and they share the same representation, while fermion has positive particle and negative particle, their representation are different.
Supposed to establish the bimodality of SO (3), call $so'(3)$, then SU (2) and SU (3) shall be the same structure of isomorphic to $so'(3)$.
Figure 6 is fermion and boson model, the area AB-O-CD (herein refers to the double horn-shaped area) stands for an anti-matter area, in which the space, time, energy and curvature are all negative, meeting Roche geometric properties [6]. While in area AB-

FE-CD (the outer surface of the spheroid) stands for normal matter-state area, in which the space, time, energy and curvature are all positive, meeting the Riemann geometric properties. The fermion particle with a non-negative half integer spin rotates in a normal space-time in a circle, then enters into the anti-spacetime to rotate for a circle, so that it can return to its original position (that is to say the fermion particle has to rotate 720 degree to return to original position). In addition, the projection of the fermion trajectory in space displays a closed string with a knot. In the same way, the boson particle with an internal spin of non-negative integer, which rotates either in normal area or anti-matter area, that is to say to make it return to the original position, it can rotate 360 degree without crossing normal area or anti-matter area. And the projection of the boson particle traveling trace in space displays a closed string. AB and DC plane act as the Horizon.

It is a singularity as well as zero hyper surface, which means that vector of this surface is equal to tangent vector, also the surface is an infinite redshift surface, that means $\Delta t = \Delta\tau/\sqrt{1-GM/c^2r}$, $\nu = \nu_0\sqrt{1-GM/c^2r}$. When $\Delta t \to \infty, \nu \to 0$, the moving status of the object on the surface will last for infinite long for an observer in a distance and the redshift will be infinite long. Furthermore, the area within Guanyiying radius is defined as inner part of a hole, if the object moves into the inner part, then the phenomenon is called a black hole, and if the object leaves for outside part, then is called a white hole.
Outside of the hole, the space metric is $g_{00}<0, g_{11}>0, g_{22}>0, g_{33}>0$, while inside the hole, for $r<GM/c^2$, therefore $g_{00}>0, g_{11}<0, g_{22}>0, g_{33}>0$. That is to say the particle rotates downward from O point anti-clockwise at a steady speed. When passing through DC plane, space-time will reverse, meanwhile time and space respectively transfer from negative to positive. In other words, the real three-dimensional anti-space in the anti-state space-time is turned into virtual one-dimensional time in a new normal space-time, while the virtual one-dimensional time in the anti-state space-time is turned into real three-dimensional space in a new normal space. In the meanwhile, property of the particle is changed where the anti-state matter changes into normal matter and the particle is negatively charged. When passing through AB plane, space-time will reverse again, then time and space will transfer from positive to negative. To put it in another way, the virtual one-dimensional time is turned into real three-dimensional anti-space (space-like), at the same time, the real three-dimensional space is turned into virtual one-dimensional (time-like) in the anti-space, likewise, the property of the particle is changed to be charged positively, and time turns from positive into negative, and the normal matter is changed into anti-state matter.

13 Conclusion

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 matter. 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.

Corresponding Author:
Guanyiying
China。
Telephone: 18745722522
E-mail: guanyiying@163.com

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