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Zeronic Field and its Intrinsic Core

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Abstract

In the case of ST LM324 being passive, the MSE (Modern Strategic Energy) signal has been miraculously discovered. MSE itself becomes the Input Currents of chips, even though it is extremely weak, it must be continuously amplified by ultra-large-scale integration. At present, the integration degree of ultra large scale （VLSI） integrated circuits has reached 6 million transistors, with a line width of 0.3 microns, it is the nanometer range. MSE is composed of infinite zerons distributing in whole space-time, while zeron is the essential particle with accompanied wave via duality.

Key words: zeron, zeronic field, nanometer range, Modern Strategic Energy, cosmic energy

The quantization of proper or intrinsic mass is an essential quantization, which can be derived directly from Einstein field equation as well as whether from the ϕ^4 theory in quantum field theory [Ref. 1] or from the special relativistic mechanics [Ref. 2], even from pure mathematics when differential geometry was initially established on curves and surfaces.

1 Essential quantization derived from helix sequence

Helix is a typical curve since differential geometry was originally established on curves and surfaces about 200 years ago (See Carl F. Gauss and that time others' articles on differential geometry). A 3-dimension helix wave, formed as a point moving along the helix, also represents an essential waving form and can be transferred to 2-dimension waving motion even 1-dimension harmonic motion. As a curve, helix has curvature and torsion, those are very important variables because their extreme values play key roles in quantization.

1.1 *Helix curve and helix sequence*

The parameterized differentiable curve given by [Ref 5: Chap.3, Sect.1]

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$$\begin{aligned}\boldsymbol{r} &= \{a\cos\varphi, a\sin\varphi, b\varphi\} \quad (a>0, \varphi\in\mathbb{R}, b\neq 0)\\ &= a\cos\varphi\boldsymbol{e}_1 + a\sin\varphi\boldsymbol{e}_2 + b\varphi\boldsymbol{e}_3\end{aligned} \tag{1}$$

has as its trace in $\mathbb{R}^3$, a helix of pitch $2\pi b$ on the cylinder $x^2+y^2=a^2$. The parameter φ here means the angle that the x axis makes with the line joining the origin 0 to the projection of the point $\boldsymbol{r}(\varphi)$ over the $x-y$ plane. The $\boldsymbol{e}$'s here are orthogonal base vectors.

Differentiating $\boldsymbol{r}$,

$$\mathrm{d}\boldsymbol{r} = \{-a\sin\varphi, a\cos\varphi, b\}\,\mathrm{d}\varphi. \tag{2}$$

Hence

$$(\mathrm{d}\boldsymbol{r})^2 = (\mathrm{d}s)^2 = (a^2+b^2)(\mathrm{d}\varphi)^2 \quad (s \text{ is arc length}). \tag{3}$$

If the increasing trend of s is the same as φ,

$$\mathrm{d}s = \sqrt{a^2+b^2}\,\mathrm{d}\varphi = R_0\mathrm{d}\varphi \overset{a^2=b^2}{===} \sqrt{2}a\mathrm{d}\varphi \quad \left(R_0 = \sqrt{a^2+b^2} \overset{a^2=b^2}{===} \sqrt{2}a\right) \tag{4}$$

where R_0 is the radial vector while a and b are extreme values of κ and τ, note that

$$R = \frac{1}{k} = \frac{a^2+b^2}{a} \overset{a^2=b^2}{===} 2a = \sqrt{2}R_0 \tag{5}$$

is the radius of curvature.

In fact, helix is not only one but a sequence $\boldsymbol{r}^{(i)}$:

$$\begin{aligned}&\boldsymbol{r}^{(i)} = a\cos S\boldsymbol{e}_1^{(i)} + a\sin S\boldsymbol{e}_2^{(i)}(-)^i|b|S\boldsymbol{e}_3^{(i)}\\ &\qquad\left(i=1,2,3,\cdots, |b|S = \left|\boldsymbol{r}^{(i-1)}\right|, a^2=b^2, S>>1, \boldsymbol{e}_3^{(i)} = \boldsymbol{e}_{r^{(i-1)}}\right),\end{aligned} \tag{6}$$

where

$$\boldsymbol{e}^{(i)} \not\equiv \boldsymbol{e}^{(i-1)}. \tag{7}$$

Every $\boldsymbol{r}^{(i+1)}$ curve is a helix rotating around $\boldsymbol{r}^{(i)}$ as its revolving axis, there are infinite multiplicity of such helices to constitute an infinite helix sequence in proper space. Then an important fact is that $\boldsymbol{r}^{(i+1)}$ has not only been opposite in revolving and increasing directions but also possessed secondary structure [Ref. DNA structure in biochemistry] which is right the $\boldsymbol{r}^{(i)}$ structure.

1.2 *Discretization of helix sequence*

An important equality should be proved now, it is

$$R^{(n+i)} = \left(\sqrt{2}\right)^i R^{(n)} \quad \left(a^2=b^2,\ n,i=0,1,2,\cdots\right). \tag{8}$$

Taking $i=1$, when $n=0$ (8) is right in expression (4) and (5) only need to assign $R^{(0)}=R_0$ and $R^{(1)}=R$. If when $n=j$, $R^{(j+1)} = \left(\sqrt{2}\right)R^{(j)}$ (still taking $i=1$) is correct, then when $n=j+1$

$$R^{(j+2)} = \sqrt{2}R^{(j+1)} = \sqrt{2}\sqrt{2}R^{(j)} = \left(\sqrt{2}\right)^2 R^{(j)}, \tag{9}$$

meeting (8), so the equality (8) can be set up when $i=1$. In general, if $i=k\ (k=0,1,2,\cdots)$ still (8) is an available one as

$$R^{(n+k)}=\left(\sqrt{2}\right)^{k}R^{(n)}, \tag{10}$$

then when $i=k+1$,

$$R^{[n+(k+1)]}=R^{[(n+k)+1]}=\sqrt{2}R^{(n+k)}=\sqrt{2}\left(\sqrt{2}\right)^{k}R^{(n)}=\left(\sqrt{2}\right)^{k+1}R^{(n)}. \tag{11}$$

Thus equality (8) is set up whatever natural-number i takes.

According to expression (8), there exists

$$k^{(i)}=\frac{1}{R^{(i)}}=\frac{1}{\left(\sqrt{2}\right)^{1}R^{(i-1)}}=\frac{1}{\left(\sqrt{2}\right)^{2}R^{(i-2)}}=\cdots=\frac{1}{\left(\sqrt{2}\right)^{i}R^{(i-i)}}=\frac{1}{\left(\sqrt{2}\right)^{i}R^{(0)}}\qquad (i=1,2,3,\cdots), \tag{12}$$

equivalent to (33) when $n=0$, i.e.,

$$R^{(i)}=\left(\sqrt{2}\right)^{i}R^{(0)}=\left(\sqrt{2}\right)^{i}R_{0}\qquad (\,i=0,1,2,\cdots). \tag{13}$$

When a point moves at light-speed c on a curve with curvature $k=1/R\neq 0$ and its angular frequency $|\boldsymbol{\omega}|=c/R$,

$$R^{2}=\left(\frac{c}{\omega}\right)^{2}. \tag{14}$$

If moving on each $\boldsymbol{r}^{(i)}\ (i=1,2,3,\cdots)$,

$$\left(\ddot{\boldsymbol{r}}^{(i)}\right)^{2}=\left(k^{(i)}\right)^{2}=\frac{1}{\left(R^{(i)}\right)^{2}}=\left(\frac{\omega^{(i)}}{c}\right)^{2}\qquad (\omega^{(0)}=\omega). \tag{15}$$

That is

$$\left(\omega^{(i)}\right)^{2}=\left(\frac{c}{R^{(i)}}\right)^{2}=\left(\frac{c}{\left(\sqrt{2}\right)^{i}R_{0}}\right)^{2}=\left(\frac{\omega_{0}}{\left(\sqrt{2}\right)^{i}}\right)^{2}\qquad \left(i=1,2,3,\cdots,|\omega_{0}|=\frac{c}{R_{0}}\right), \tag{16}$$

which means, if $\omega_0^{(i)}$ is marked to replace $\omega^{(i)}$ here,

$$\left|\omega_{0}^{(i)}\right|=\frac{|\omega_{0}|}{\left(\sqrt{2}\right)^{i}}\qquad (i=1,2,3,\cdots). \tag{17}$$

This is describing discretization of helix sequence.

1.3 *Essential quantization derived from helix sequence via duality*

The frequency $|\boldsymbol{\omega}|$ is waving frequency, together with the wave amplitude a and the wave phase φ, the parameterized differentiable expressions of helix represent not merely the helical curve but also an essential sort of wave and waving form for all in motion including matter.

As matter wave, de Broglie wave [Ref. 4: p. 825] results in the relation about wave-particle duality

$$mc^2 = \hbar|\omega| \ (m = m^{(0)}) \ \Rightarrow \ m_0 c^2 = \hbar|\omega_0| \tag{18}$$

where $|\omega|$ is de Broglie wave angular frequency corresponding to particle mass m while m_0 is rest mass to which $|\omega_0|$ is corresponding and $\hbar$ is Planck constant (reduced).

From now on in this article, proper masses have been becoming proper waves, or say more correctly, proper gravitational waves. This is important line of demarcation, because proper wave is easier to detect in technology, there exists proper mass everywhere in our universe and then can exploit proper gravitational wave everywhere as our energy, called cosmic energy.

Let

$$\left(\omega^{(i)}\right)^2 - \left(\omega_0^{(i)}\right)^2 = \left(\omega_{\mathrm{v}}^{(i)}\right)^2 \quad (i = 0,1,2,\cdots,\ \omega^{(0)} = \omega,\ \omega_{0/\mathrm{v}}^{(0)} = \omega_{0/\mathrm{v}},\ \omega^{(i)} = \omega_0^{(i-1)} \text{ for } i > 0) \tag{19}$$

meeting

$$\left(\omega_0^{(i)}\right)^2 = \left(\omega_{\mathrm{v}}^{(i)}\right)^2 = \frac{\left(\omega_0^{(i-1)}\right)^2}{2} \quad (i = 1,2,3,\cdots), \tag{20}$$

where $\left(\omega^{(i)}\right)^2$ is the sum of $\left(\omega_0^{(i)}\right)^2$ on time dimension plus $\left(\omega_{\mathrm{v}}^{(i)}\right)^2$ on moving direction dimension [Ref. 1： expressions (40) to (52)] while $\left(\omega_0^{(i)}\right)^2$ will also have four dimensions when being the sum of $\left(\omega_0^{(i+1)}\right)^2$ and $\left(\omega_{\mathrm{v}}^{(i+1)}\right)^2$. Therefore $\left(\omega_0^{(i)}\right)^2$ can become connection to weave a net all over the entire space-time as $R^{(i)} \to \infty$ when $i \to \infty$. Then

$$\boldsymbol{\omega}^{(i)} - \boldsymbol{\omega}_0^{(i)} = \boldsymbol{\omega}_{\mathrm{v}}^{(i)} \quad \boldsymbol{\omega}_0^{(i)} \cdot \boldsymbol{\omega}_{\mathrm{v}}^{(i)} = 0 \quad (i = 0,1,2,\cdots,\ \boldsymbol{\omega}^{(0)} = \boldsymbol{\omega},\ \boldsymbol{\omega}_{0/\mathrm{v}}^{(0)} = \boldsymbol{\omega}_{0/\mathrm{v}},\ \boldsymbol{\omega}^{(i)} = \boldsymbol{\omega}_0^{(i-1)} \text{ for } i > 0). \tag{21}$$

So there is vector wave [Ref. 4: p. 288, p. 292 plus p. 817] that belongs to electromagnetic wave formed in light-speed motion.

Via expressions (17) and (18), the m_0 becomes discrete rest mass

$$m_0^{(i)} = \frac{m_0}{\left(\sqrt{2}\right)^i} \qquad (\ i = 1,2,3,\cdots;\ m_0 = m_0^{(0)}) \tag{22}$$

together with

$$m_0^{(i)} c^2 = \hbar\left|\omega_0^{(i)}\right| \quad (i = 0,1,2,\cdots;\ m_0^{(0)} = m_0) \tag{23}$$

and

$$m_{\mathrm{v}}^{(i)} c^2 = \hbar\left|\omega_{\mathrm{v}}^{(i)}\right| \quad (i = 0,1,2,\cdots;\ m_{\mathrm{v}}^{(0)} = m_{\mathrm{v}}). \tag{24}$$

Since

$$mr = \frac{\hbar\,|\,\omega\,|}{c^2} r = \frac{\hbar}{c} \quad \text{when } |\,\omega\,|\, r = c\,, \tag{25}$$

if m or $|\,\omega\,|$ is big, r and wave length must be small. Only during m is being small enough to be near m_0 in microphysics, the wave length becomes large enough to be detected and the intrinsic helix wave with this microeffect will be manifest in the locality.

Relying on expressions (17) and (22) under such microeffect, helix sequence system has been quantized proper mass system (proper system for short) in which expressions (17) and (22) have been the quantization about either mass m_0 of m_0c^2 or frequency $|\omega_0|$ of $\hbar|\omega_0|$ and called essential quantization in proper system. This is a typical Macroscopic Quantum Effect predicted when essential quantization can be derived from Einstein field equation in general relativistic mechanics which deals with long time macroscopic physics of celestial bodies.

As known [Ref. Subsection 1.2 of this article] $\boldsymbol{\omega}_{\mathrm{v}} = \boldsymbol{\omega}_{\mathrm{v}}^{(0)}$ is called kinetic waving velocity, while present $m_{\mathrm{v}} = m_{\mathrm{v}}^{(0)}$ is called kinetic (proper) mass. According to above expressions, let

$$\left|\omega_0^{(i)}\right| - \left|\omega_0^{(i+1)}\right| = \frac{\left(\omega_{\mathrm{v}}^{(i+1)}\right)^2}{\left|\omega_0^{(i)}\right| + \left|\omega_0^{(i+1)}\right|} = \left|\omega_{\mathrm{f}}^{(i+1)}\right| \quad (i = 0, 1, 2, \cdots)\,, \tag{26}$$

then

$$\omega_{\mathrm{f}}^{(i+1)} = \omega_0^{(i)} \mp \left|\omega_0^{(i+1)}\right| \begin{cases} > 0 \ \text{ if } \omega_0^{(i)} > 0 \\ < 0 \ \text{ if } \omega_0^{(i)} < 0 \end{cases} \quad (i = 0, 1, 2, \cdots) \tag{27}$$

when $|\omega_{\mathrm{f}}| = \left|\omega_{\mathrm{f}}^{(0)}\right| = |\omega| - |\omega_0|$ is called dynamic waving frequency, that is

$$m_0^{(i)} - m_0^{(i+1)} = \frac{\left(m_{\mathrm{v}}^{(i+1)}\right)^2}{m_0^{(i)} + m_0^{(i+1)}} = m_{\mathrm{f}}^{(i+1)} \quad (i = 0, 1, 2, \cdots) \tag{28}$$

when $m_{\mathrm{f}} = m_{\mathrm{f}}^{(0)} = m - m_0$ is called dynamic (proper) mass.

The relation among the curvature κ, the normal curvature κ_{n} and the geodesic curvature κ_{g} of a curve on a surface is [Ref. 5: Chap. 8, Sect. 5. expression (6)]

$$\kappa^2 = \kappa_{\mathrm{n}}^2 + \kappa_{\mathrm{g}}^2 \tag{29}$$

where

$$\kappa_{\mathrm{n}} = \kappa\cos\theta \quad \text{and} \quad |\kappa_{\mathrm{g}}| = \kappa\sin\theta\,, \tag{30}$$

θ is magnitude of the angle between the normal vector $\boldsymbol{\beta}$ of the curve and the normal vector $\boldsymbol{n}$ of the surface at the same point. In Frenet frame in which the unit tangent vector

$$\boldsymbol{\alpha} = \frac{\boldsymbol{u}}{|u|} \tag{31}$$

is unit velocity. As either $\alpha\cos\theta$ or $\alpha\sin\theta$ is less than or equals to the unit 1, so the α corresponds to the maximal speed - light speed c - as a limit. Helix is the geodesic line on cylindrical surface [Ref 5: Chap.8, Subsection 6.1 (iii)]. The geodesic line keeps geodesic curvature $|\kappa_{\mathrm{g}}| = \kappa\sin\theta \equiv 0$ [Ref 5: Cha p.8, Subsection 6.1], that is, $\cos\theta = \frac{|u|}{c} \equiv 1 \Rightarrow |u| \equiv c$ [Ref. Subsection 1.2 of this article]. So, helix expression (1) is the free-moving path for any zero-proper-mass particle.

2 Helix motion is determined by velocity itself

Helix motion is determined by velocity itself as basic motion form to be the first structure, any outside factor caused motion is only the second or the third or even higher degree of motion.

As known, the intensity of any wave of course including spiral wave, is direct proportion to the square of amplitude or the scalar product of amplitude [Ref. 6: P. 146].

The particle has wavelike properties, the amplitude propagating as a wave number equal to momentum divided by $\hbar$ [Ref. 3: p. 3-4, expression (3.7) and its explanation below in the paragraph], the scalar product of momentum $\boldsymbol{p}$ can be expanded in series when $\boldsymbol{p}$ forms the amplitude, that is, here only expand the velocity $\boldsymbol{u}\cdot\boldsymbol{u}=u^2$,

$$p^2=\boldsymbol{p}\cdot\boldsymbol{p}=m^2\boldsymbol{u}\cdot\boldsymbol{u}=m^2u^2=m^2\sum_{i=0}^{\infty}u_i^2 \tag{32}$$

where

$$u_i=u\sqrt{\left(1-\frac{u^2}{c^2}\right)\left(\frac{u^2}{c^2}\right)^i}\ . \tag{33}$$

If write

$$X^{i\cdots k}=\sum_{n=i}^{k}X^n \quad X^{\cdots i}=X^{0\cdots i}\ X^{k\cdots}=X^{k\cdots\infty} \tag{34}$$

or

$$Y_{i\cdots k}=\sum_{n=i}^{k}Y^n \quad Y_{\cdots i}=Y_{0\cdots i}\ Y_{k\cdots}=Y_{k\cdots\infty} \tag{35}$$

where X and Y may be vectors. It is obvious that

$$\boldsymbol{u}_{\cdots i}+\boldsymbol{u}_{(i+1)\cdots}=\boldsymbol{u} \quad \text{and} \quad \boldsymbol{u}_{\cdots i}\cdot\boldsymbol{u}_{(i+1)\cdots}=0\,. \tag{36}$$

Set a rotating cylindrical coordinate system $O(r,\phi,z)$ with axis $\boldsymbol{z}$ always parallel to $\boldsymbol{u}_{\cdots i}$ and keeping $\boldsymbol{u}_{(i+1)\cdots}$ to point at positive direction. Note that the polar vector

$$\boldsymbol{r}=\boldsymbol{\rho}+\boldsymbol{a} \tag{37}$$

with the same origin as origin of the rest coordinate system , where $\boldsymbol{a}$ is the radial vector with the cylinder $x^2+y^2=a^2$ in helix expression, once a is chosen its magnitude is fixed. It may by that $\rho\geq 0$. On the rotating coordinate system $O(r,\phi,z)$, let

$$\boldsymbol{u}_{(i+1)\cdots}=(u_{(i+1)\cdots})_\rho\boldsymbol{i}+(u_{(i+1)\cdots})_\phi\boldsymbol{j} \tag{38}$$

where the unit vectors $\boldsymbol{i},\boldsymbol{j},\boldsymbol{k}$ meet $(r=\rho+a)\boldsymbol{i}$ or $\phi\boldsymbol{j}$ and $z\boldsymbol{k}$, and

$$\boldsymbol{a}_{(i+1)\cdots}\frac{\mathrm{d}\boldsymbol{u}_{(i+1)\cdots}}{\mathrm{d}t}=\frac{\mathrm{d}(u_{(i+1)\cdots})_\rho}{\mathrm{d}t}\boldsymbol{i}+\frac{\mathrm{d}(u_{(i+1)\cdots})_\phi}{\mathrm{d}t}\boldsymbol{j}+\boldsymbol{w}_{(i+1)\cdots}\times\boldsymbol{u}_{(i+1)\cdots} \tag{39}$$

where $\boldsymbol{w}_{(i+1)\cdots}$ is the rotation of $\boldsymbol{u}_{(i+1)\cdots}$ with the rotating $O(r,\phi,z)$ [Ref. 7: expression (4.2.4)]. When $\rho\neq 0$, $\boldsymbol{w}_{(i+1)\cdots}\times\boldsymbol{u}_{(i+1)\cdots}$ leads

$$\boldsymbol{w}_{(i+1)\cdots}\times(u_{(i+1)\cdots})_\rho\boldsymbol{i}=w_{(i+1)\cdots}(u_{(i+1)\cdots})_\rho(+\boldsymbol{j})\ \ , \tag{40}$$

and

$$w_{(i+1)\cdots}\times(u_{(i+1)\cdots})_\phi\boldsymbol{j}=w_{(i+1)\cdots}(u_{(i+1)\cdots})_\phi(-\boldsymbol{i}) \tag{41}$$

where $w_{(i+1)\cdots}$ and $(u_{(i+1)\cdots})_\rho$, or. $w_{(i+1)\cdots}$ and $(u_{(i+1)\cdots})_\phi$ may always have the same sign and their production must be positive. The expression (41) means the number of ρ along ($+\boldsymbol{i}$) will get smaller and smaller even to zero. When $\rho \to 0$,

$$\rho \to 0 \Rightarrow (u_{(i+1)\cdots})_\rho \to o, r \to a, (u_{(i+1)\cdots})_\phi \to u_{(i+1)\cdots} = \text{constant}, \boldsymbol{u}_{(i+1)\cdots} \to u_{(i+1)\cdots}\boldsymbol{j}. \quad (42)$$

Therefore it is actually helix motion. If write

$$\boldsymbol{u}_l = \boldsymbol{u}_{\cdots i} \quad \boldsymbol{u}_r = \boldsymbol{u}_{(i+1)\cdots} \quad (43)$$

where $\boldsymbol{u}_l$ represents linear velocity while $\boldsymbol{u}_r$ represents revolving velocity. Then

$$u^2 = u_l^2 + u_r^2 \quad \boldsymbol{u} = \boldsymbol{u}_l + \boldsymbol{u}_r \quad \boldsymbol{u}_l \cdot \boldsymbol{u}_r = 0 \quad (44)$$

To find the revolving radius $\boldsymbol{r}_r$, let

where $\boldsymbol{\omega}_r$ is angular frequency, $|\boldsymbol{\omega}_r| = 2\pi\nu$ and ν is rotational frequency [Ref. 4: p. 32], $\nu = |u_0|/\lambda$ now, λ is wave length. If $\boldsymbol{u}_{1\cdots} = \boldsymbol{u}_r$, thus

$$r_r = |\boldsymbol{r}_r| = \frac{|\boldsymbol{u}_{1\cdots}|}{|\boldsymbol{\omega}_r|} = \frac{\hbar}{m_0 c} \geq a \quad (45)$$

Because momentum or its velocity is regarded as having wavelike property, it must show any motion is helix motion as its first structure.

Helix motion is determined by velocity itself as basic motion to be the first structure, any outside factor caused motion is only the seond or the third or even higher degree of motion. If expanding with mass m in $p^2 = \boldsymbol{p} \cdot \boldsymbol{p} = m^2 \boldsymbol{u} \cdot \boldsymbol{u}$, the particle can be quantized in theory toform a particle wave of helix, this is right the theory reason of duality.

3 Zeron

As

$$\boldsymbol{\omega}_{\mathrm{v}}^{(i)} = c\boldsymbol{\kappa}^{(i)} = c\boldsymbol{p}^{(i)}/\hbar = cm_0^{(i-1)}\boldsymbol{u}^{(i)}/\hbar = (m_0^{(i-1)}c^2)\boldsymbol{u}^{(i)}/\hbar c = \frac{(\hbar\,|\,\omega_0^{(i-1)}\,|)\boldsymbol{u}^{(i)}}{\hbar c} = \frac{|\,\omega_0\,|\,\boldsymbol{u}^{(i)}}{\left(\sqrt{2}\right)^{i-1} c} \quad (46)$$

$$(i = 1, 2, 3, \cdots)$$

and

$$\boldsymbol{\omega}_{\mathrm{v}} = c\boldsymbol{\kappa} = c\boldsymbol{p}/\hbar = cm\boldsymbol{u}/\hbar = (mc^2)\boldsymbol{u}/\hbar c = \frac{(\hbar\,|\,\omega\,|)\boldsymbol{u}}{\hbar c} = \frac{|\,\omega\,|\,\boldsymbol{u}}{c} \quad (\boldsymbol{u} = \boldsymbol{u}^{(0)}) \quad (47)$$

corresponding

$$m_{\mathrm{v}}^{(i)} = \frac{|p^{(i)}|}{c} = \frac{m_0^{(i-1)}|u^{(i)}|}{c} = \frac{m_0}{\left(\sqrt{2}\right)^{i-1}}\frac{|u^{(i)}|}{c} \quad (i = 1, 2, 3, \cdots), \quad (48)$$

and

$$m_{\mathrm{v}} = \frac{|p|}{c} = \frac{m|u|}{c}. \quad (49)$$

Note that

$$\boldsymbol{\omega} = \boldsymbol{\omega}_{\mathrm{v}} + \boldsymbol{\omega}_0 = \boldsymbol{\omega}_{\mathrm{v}} + \boldsymbol{\omega}_{\mathrm{v}}^{(1)} + \boldsymbol{\omega}_0^{(1)} = \cdots = \boldsymbol{\omega}_{\mathrm{v}} + \sum_{i=1}^{\infty} \boldsymbol{\omega}_{\mathrm{v}}^{(i)} = \frac{|\omega|}{c}\boldsymbol{u}^{(0)} + \left[\frac{|\omega_0|}{c}\sum_{i=1}^{\infty}\frac{\boldsymbol{u}^{(i)}}{(\sqrt{2})^{i-1}}\right]_{u=0}$$
$$\Rightarrow \; c\mathbf{e} = c\frac{\boldsymbol{\omega}}{|\omega|} = \boldsymbol{u} + \left[\frac{|\omega_0|}{|\omega|}\sum_{i=1}^{\infty}\frac{\boldsymbol{u}^{(i)}}{(\sqrt{2})^{i-1}}\right]_{u=0} \quad \left(\mathbf{e} = \frac{\boldsymbol{\omega}}{|\omega|}\right) \tag{50}$$

where

$$\boldsymbol{\omega}_0 = \sum_{i=1}^{\infty}\boldsymbol{\omega}_{\mathrm{v}}^{(i)} \equiv \left[\frac{|\omega_0|}{c}\sum_{i=1}^{\infty}\frac{\boldsymbol{u}^{(i)}}{(\sqrt{2})^{i-1}}\right]_{u=0} \tag{51}$$

is proper quantity.

Now, whether $m_0 = 0$, that is, $\boldsymbol{\omega}_0 = 0$ and $\boldsymbol{\omega} = \boldsymbol{\omega}_{\mathrm{v}} \;\Rightarrow$

$$c\mathbf{e}_{\mathrm{v}} = c\frac{\boldsymbol{\omega}_{\mathrm{v}}}{|\omega_{\mathrm{v}}|} = \boldsymbol{u} \quad \left(\mathbf{e}_{\mathrm{v}} = \frac{\boldsymbol{\omega}_{\mathrm{v}}}{|\omega_{\mathrm{v}}|}\right); \tag{52}$$

or $\boldsymbol{u} = 0$, that is, $|\omega| = |\omega_0|$ and $\boldsymbol{\omega} = \boldsymbol{\omega}_0 \;\Rightarrow$

$$c\mathbf{e}_0 = c\frac{\boldsymbol{\omega}_0}{|\omega_0|} = \sum_{i=1}^{\infty}\frac{\boldsymbol{u}^{(i)}}{(\sqrt{2})^{i-1}} \quad \left(\mathbf{e}_0 = \frac{\boldsymbol{\omega}_0}{|\omega_0|}\right). \tag{53}$$

Therefore,

$$c\mathbf{e} = \boldsymbol{u} + c\mathbf{e}_0, \tag{54}$$

this is vector expression about constant light-speed, while light-ray may be refracted. Only when the unit vectors $\mathbf{e}$, $\mathbf{e}_0$ and $\mathbf{e}_{\mathrm{v}}$ have been fixed meeting this expression, any length, such as $|\boldsymbol{u}|$ or $|\boldsymbol{\omega}_{(0/\mathrm{v})}|$, can be determined.

Above conclusions have no any contradiction, because both massless and massive particles are already united as zeron − zero-proper-mass particle.

What is resting when $m = m_0^{(i)}$ is only a center-of-rotation (or say center-of-curvature) of intrinsic $\boldsymbol{\omega}_0^{(i)}$. Such a point is a zeron. Its characteristic can be shown as

$$Q = \left.\frac{Q_0}{\sqrt{1-u^2/c^2}}\right|_{Q_0=0} = \begin{cases} 0 & \text{when } u^2 \neq c^2 \\ \text{some constant} & \text{when } u^2 = c^2 \end{cases} \tag{55}$$

where Q may be $m, \omega, p\left(=|\boldsymbol{p}|\right), \kappa, E$ (energy) and other relevant quantities, Q_0 takes the value of Q when $m_0 = 0$ and $u = 0$. When the zeron's speed is less than c, it is an implicit particle; but when its speed is equal to c, it becomes an explicit zero-proper-mass particle. This characteristic can reveal that EmDrive [Ref.: www.emdrive.com] does not violate any laws of physics.

Let

$$u^{(i)} = \pm c\sqrt{1-\left(\frac{m_0^{(j)}}{m_0^{(i)}}\right)^2} \qquad (i > 0). \tag{56}$$

Then

$$u^{(i)}=\begin{cases}0 \text{ when } j=i\\ \pm\dfrac{c}{\sqrt{2}} \text{ when } j=i+1\\ \pm c \text{ when } j=\infty\\ \pm \mathrm{i}c \text{ when } j=i-1\end{cases}. \tag{57}$$

* (This paragraph is as additional reference) The proof of wave-particle duality can be also given for a Dirac particle in quantum field theory - *Dirac particle is also a massless quantum*.

The Lagrangian for a spinor (spin - $\frac{1}{2}$) field is

$$\mathcal{L}=i(\hbar c)\bar{\psi}\gamma^{\mu}\partial_{\mu}\psi-\left(m_0c^2\right)\bar{\psi}\psi \tag{58}$$

where m_0 is the proper mass, either ψ or $\bar{\psi}$ is an independent field variable. Applying the Euler-Lagrange equation to ψ, the adjoint Dirac equation

$$i\partial_{\mu}\bar{\psi}\gamma^{\mu}+\left(\frac{m_0c}{\hbar}\right)\bar{\psi}=0 \tag{59}$$

can be established adjoining the Dirac equation

$$i\gamma^{\mu}\partial_{\mu}\psi-\left(\frac{m_0c}{\hbar}\right)\psi=0. \tag{60}$$

Then the Lagrangian above becomes

$$\begin{aligned}\mathcal{L}&=i(\hbar c)\bar{\psi}\gamma^{\mu}\partial_{\mu}\psi-\left[-i(\hbar c)\partial_{\mu}\bar{\psi}\gamma^{\mu}\right]\psi\\&=i(\hbar c)\left[\bar{\psi}\gamma^{\mu}\partial_{\mu}\psi+\partial_{\mu}\bar{\psi}\gamma^{\mu}\psi\right]\\&=i(\hbar c)\partial_{\mu}\left(\bar{\psi}\gamma^{\mu}\psi\right)\equiv 0\end{aligned} \tag{61}$$

because the vector current $\bar{\psi}\gamma^{\mu}\psi$ is always conserved if ψ satisfies the Dirac equation. Thus the Hamiltonian is

$$H=\text{constant}. \tag{62}$$

That there is no mass term here in the Lagrangian and there is no varying of energy accumulated from the whole space proves that a definite Dirac field represents not only a massive Dirac particle but also a massless field quantum. As known, any massless, i.e., zero-proper-mass quantum is a zeron, both a zero-proper-mass particle such as a photon and a nonzero-proper-mass particle such as an electron are zerons.

4 Zeronic field and its intrinsic core

4.1 *Zeronic field*

Although all $\boldsymbol{\omega}_{\mathrm{v}}^{(i+1)}$'s $(i\geq 0)$ are completely intrinsic quantities, yet their vectorial sum $\boldsymbol{\omega}_0$ is not, as the speed of m_0 is u - an extrinsic quantity and $\boldsymbol{\omega}_0$ has handed direction only when $u\neq 0$. Call $\boldsymbol{\omega}_0$ an out-looking intrinsic quantity or external proper quantity. In other words, $\boldsymbol{\omega}_0$ is an out-looking shell, while $\boldsymbol{\omega}_{\mathrm{v}}^{(1)}$, $\boldsymbol{\omega}_0^{(1)}$ and $\left(\omega_0^{(1)}\right)_{\mathrm{ft}} = \sum_{i=2}^{\infty} \omega_{\mathrm{f}}^{(i)}$ make up an intrinsic core as a whole - intrinsic construction of zeronic field. A particle composed of monoset of zerons is called a monocore particle, and it is called a bicore particle if it is composed of biset of zerons. All other relevant quantities and all other particles can be classified on the analogy of these.

4.2 *Stable Intrinsic Core*

At the state with the minimum potential $V_{\min} = 0$, a stable intrinsic core, for short, a sic − a sic in the intrinsic 4-dimensional space-time can be formed in zeronic field. Let the potential energy

$$\phi = -\int f\,\mathrm{d}r = -\int \frac{\hbar c}{r^2}\mathrm{d}r = \frac{\hbar c}{r} - C \equiv 0, \tag{63}$$

where C is integer constant.

$$f = mc|\omega| = \frac{\hbar|\omega|^2}{c} = \frac{\hbar c}{r^2} \quad \left(c = |\omega| r\right) \tag{64}$$

then

$$C = \frac{\hbar c}{r_C} = \begin{cases} 0 & \text{when } r_C = \infty \text{ and } f = 0 \\ \text{nonzero constant} & \text{when } r_C < \infty \text{ and } f > 0. \end{cases} \tag{65}$$

This is the inevitable outcome resulting from the relativistic relation between the whole-space-distribution and the finite-space-appearance of a nonzero-proper-mass particle. When $f > 0$, if $r < r_C$, then $\phi > 0$, which means the centrifugal tendency is more than the centripetal tendency and hence $r \to r_C$; if $r > r_C$, then $\phi < 0$, which means the centrifugal tendency is less than the centripetal tendency and hence $r \to r_C$, too. So there is a stable state in which the centrifugal tendency is counteracted by a constant centripetal tendency at where $r_C < \infty$. This state is a stable bound state, while another stable state existing at where $r_C = \infty$ is a stable free state. The forming of such a stable bound state is a necessary, but not sufficient, condition to form a ground state of a nonzero-proper-mass particle. Another relevant necessary condition is that the handed direction of $\boldsymbol{\omega}_0^{(i+1)}$ must be different from that of $\boldsymbol{\omega}_0^{(i+2)}$ and that of $\boldsymbol{\omega}_{\mathrm{v}}^{(i+2)}$. If observing $\boldsymbol{\omega}_0^{(i+1)}$ at the level $i+2$, only a relative waving velocity $(\boldsymbol{\omega}_0^{(i+1)} - \boldsymbol{\omega}_0^{(i+2)})$, or $(\boldsymbol{\omega}_0^{(i+1)} - \boldsymbol{\omega}_{\mathrm{v}}^{(i+2)})$, can be measured. Then the attractive force maintaining the waving velocity is proportional to the square of this vectorial difference. To get the greatest attractive force and the stable structure, the handed direction of $\boldsymbol{\omega}_0^{(i+1)}$ must be different from that of $\boldsymbol{\omega}_0^{(i+2)}$ and that of $\boldsymbol{\omega}_{\mathrm{v}}^{(i+2)}$, and then $\boldsymbol{\omega}_0^{(i+1)}$ and $\boldsymbol{\omega}_{\mathrm{v}}^{(i+1)}$ have the same handed direction.

Modern strategic energy comes from proper mass. As long as there is proper mass, there is so-called modern strategic energy. If there is no proper mass, how can there be this world? There is no geographical difference in modern strategic energy. It can be said that "In front of energy, everyone is equal, as long as they are upright." Modern strategic energy is ubiquitous, and no matter how far away the planet is, there is no shortage of modern strategic energy. Therefore, modern strategic energy is cosmic energy, applicable to all places in the universe, while old energy is only the Earth energy. MSE is a full spectrum energy source, which covers frequencies from zero to infinite large, otherwise it cannot form direct current electromagnetic waves, but it is different from electromagnetic waves that only focus on a certain frequency band, which is an important feature. MSE exists in a zeronic field, and a major issue is: can a zeronic field be used as a carrier? In this way, our signal can spread throughout the entire universe.

5 About sic (stable intrinsic core)

5.1 $\omega_0^{(1)}$ **and** $m_0^{(1)}$

As known,

$$\begin{aligned}
&\left(\omega_0^{(1)}\right)^2=\left(\omega_{\mathrm{v}}^{(2)}\right)^2+\left(\omega_0^{(2)}\right)^2 \Rightarrow \boldsymbol{\omega}_0^{(1)}=\boldsymbol{\omega}_{\mathrm{v}}^{(2)}+\boldsymbol{\omega}_0^{(2)}\\
&\left(\omega_0^{(2)}\right)^2=\left(\omega_{\mathrm{v}}^{(3)}\right)^2+\left(\omega_0^{(3)}\right)^2 \Rightarrow \boldsymbol{\omega}_0^{(2)}=\boldsymbol{\omega}_{\mathrm{v}}^{(3)}+\boldsymbol{\omega}_0^{(3)}\\
&\cdots\cdots\\
&\boldsymbol{\omega}_0^{(1)}=\sum_{n=2}^{\infty}\boldsymbol{\omega}_{\mathrm{v}}^{(n)}.
\end{aligned} \tag{66}$$

Quoting expression (45)

$$\left(\omega_0^{(i)}\right)^2=\left(\omega_{\mathrm{v}}^{(i)}\right)^2=\frac{\left(\omega_0^{(i-1)}\right)^2}{2} \quad (i=1,2,3,\cdots), \tag{67}$$

so,

$$\begin{aligned}
\left(\omega_0^{(1)}\right)^2&=\left(\omega_{\mathrm{v}}^{(2)}\right)^2+\left(\omega_0^{(2)}\right)^2=\left(\omega_{\mathrm{v}}^{(2)}\right)^2+\left(\omega_{\mathrm{v}}^{(3)}\right)^2+\left(\omega_0^{(3)}\right)^2=\cdots\\
&=\sum_{i=2}^{\infty}\left(\omega_{\mathrm{v}}^{(i)}\right)^2=\sum_{i=2}^{\infty}\left(\omega_0^{(i)}\right)^2
\end{aligned} \tag{68}$$

that is

$$\left(\omega_0^{(1)}\right)^2=\sum_{i=2}^{\infty}\left(\omega_0^{(i)}\right)^2 \tag{69}$$

and

$$\left(m_0^{(1)}\right)^2=\sum_{i=2}^{\infty}\left(m_0^{(i)}\right)^2. \tag{70}$$

5.2 $\omega_{\mathrm{v}}^{(1)}$ **and** $m_{\mathrm{v}}^{(1)}$

Again quoting expression (45),

$$\left(\omega_{\mathrm{v}}^{(1)}\right)^2=\left(\omega_0^{(1)}\right)^2=\sum_{i=2}^{\infty}\left(\omega_{\mathrm{v}}^{(i)}\right)^2 \tag{71}$$

and

$$\left(m_{\mathrm{v}}^{(1)}\right)^2=\sum_{i=2}^{\infty}\left(m_{\mathrm{v}}^{(i)}\right)^2 \tag{72}$$

5.3 $\left(\omega_0^{(1)}\right)_{\text{ft}}$ **and** $\left(m_0^{(1)}\right)_{\text{ft}}$

When $\omega_0^{(i)}$ or $\omega_{\text{f}}^{(i+1)}$ changes signs alternately as i varies one by one,

$$\left(\omega_0^{(i)}\right)_{\text{ft}}^2=\left(\omega_{\text{f}}^{(i+1)\cdots}\right)^2=\left(\sum_{l=i+1}^{\infty}\omega_{\text{f}}^l\right)^2=\left[\pm\sum_{l=i+1}^{\infty}(-)^l\left|\omega_{\text{f}}^l\right|\right]^2$$

$$=\left[\pm\sum_{l=i+1}^{\infty}(-)^l\left(\left|\omega_0^{(l-1)}\right|-\left|\omega_0^{(l)}\right|\right)\right]^2=\left(\sqrt{2}-1\right)^2\left[\sum_{l=i+1}^{\infty}(-)^l\frac{\left|\omega_0\right|}{\left(\sqrt{2}\right)^l}\right]^2$$

$$=\left(\sqrt{2}-1\right)^2\left[(-)^{i+1}\frac{\left|\omega_0\right|}{\left(\sqrt{2}\right)^{i+1}}+(-)^{i+2}\frac{\left|\omega_0\right|}{\left(\sqrt{2}\right)^{i+2}}+(-)^{i+3}\frac{\left|\omega_0\right|}{\left(\sqrt{2}\right)^{i+3}}+\cdots\right]^2$$

$$=\left(\sqrt{2}-1\right)^2\left\{(-)^{i+1}\left(\sqrt{2}-1\right)\left|\omega_0\right|\left[\frac{1}{\left(\sqrt{2}\right)^{i+2}}+\frac{1}{\left(\sqrt{2}\right)^{i+4}}+\frac{1}{\left(\sqrt{2}\right)^{i+6}}+\cdots\right]\right\}^2$$

$$=\left(\sqrt{2}-1\right)^2\left\{\left(\sqrt{2}-1\right)^2\left|\omega_0\right|^2\left[\frac{1}{\left(\sqrt{2}\right)^i}\sum_{k=1}^{\infty}\left(\frac{1}{2}\right)^k\right]^2\right\}$$

$$=\left(3-2\sqrt{2}\right)^2\left(\frac{\omega_0}{\left(\sqrt{2}\right)^i}\right)^2=\left(3-2\sqrt{2}\right)^2\left(\omega_0^{(i)}\right)^2, \tag{73}$$

that is

$$\left(\omega_0^1\right)_{\text{ft}}^2=\left(3-2\sqrt{2}\right)^2\left(\omega_0^1\right)^2 \tag{74}$$

and

$$\left(m_0^{(1)}\right)_{\text{ft}}^2=\left(3-2\sqrt{2}\right)^2\left(m_0^{(1)}\right)^2. \tag{75}$$

Therefore

$$m_{\text{v}}^{(1)}+m_0^{(1)}+\left(m_0^{(1)}\right)_{\text{ft}}=\left[1+1+(3-2\sqrt{2})\right]m_0^{(1)}=(5-2\sqrt{2})\ m_0^{(1)} \tag{76}$$

or

$$\left|\omega_{\text{v}}^{(1)}\right|+\left|\omega_0^{(1)}\right|+\left|\left(\omega_0^{(1)}\right)_{\text{ft}}\right|=(5-2\sqrt{2})\left|\omega_0^{(1)}\right|. \tag{77}$$

The coefficient （$5-2\sqrt{2}$）is very important in physics，such as in particle physics to calculate electron mass and the masses of heavier baryons in octet and decuplet，

6 Loop Quantum and Big Bang in Cosmos

Quantized geometry is natural phenomenon once expanding the definition region of i to negative region

6.1 *Negative definition region of i*

According to expression (12), $R=\sqrt{2}R_0$ is the radius of curvature. After quantization, it can be written as

$$R^{(i)}=\left(\sqrt{2}\right)^{i}R^{(0)}=\left(\sqrt{2}\right)^{i}R_0 \qquad (i=0,1,2,\cdots,\infty). \tag{78}$$

Now expanding the definition region of i to negative region $-i$ and getting

$$R^{(-i)}=\left(\sqrt{2}\right)^{-i}R_0 \qquad (i=1,2,3,\cdots,\infty). \tag{79}$$

When $i=k$, if this expression exists, then when $i=k+1$

$$R^{-(k+1)}=R^{-k}\left(\sqrt{2}\right)^{-1}R_0=\left(\sqrt{2}\right)^{-(k+1)}R_0 \qquad (i=1,2,3,\cdots,\infty). \tag{80}$$

So,

$$R^{(i)}=\left(\sqrt{2}\right)^{i}R_0 \qquad (i=-\infty,\cdots,-3,-2,-1,0,1,2,3,\cdots,+\infty) \tag{81}$$

From expression (40), curvature meets

$$\left(k^{(i)}\right)^2=\left(\ddot{\boldsymbol{r}}^{(i)}\right)^2=\frac{1}{\left(R^{(i)}\right)^2}=\left(\frac{1}{\left(\sqrt{2}\right)^{i}R_0}\right)^2==\left(\frac{\omega^{(i)}}{c}\right)^2 \tag{82}$$

$$(i=-\infty,\cdots,-3,-2,-1,0,1,2,3,\cdots,+\infty),$$

resulting in quantized geometry.

6.2 *Loop quantum*

When $b\to 0$ in expressions (1) and (20), there appear intersecting quantized loops from

$$\boldsymbol{r}=\{a\cos\varphi,a\sin\varphi\}=a\cos\varphi\boldsymbol{e}_1+a\sin\varphi\boldsymbol{e}_2 \tag{83}$$

with [Ref. Expression (12) of this article] and finally becoming

$$a=\frac{R_0}{\sqrt{2}}=\frac{R^{(i)}}{\left(\sqrt{2}\right)^{i+1}} \qquad (i=-\infty,\cdots,-3,-2,-1,0,1,2,3,\cdots,+\infty) \tag{84}$$

and the quantized loops

$$\boldsymbol{l}^{(i)}=\{a\cos\varphi,a\sin\varphi\}=a\cos\varphi\boldsymbol{e}_1+a\sin\varphi\boldsymbol{e}_2=\frac{R^{(i)}}{\left(\sqrt{2}\right)^{i+1}}\left(\cos\varphi\boldsymbol{e}_1+\sin\varphi\boldsymbol{e}_2\right) \tag{85}$$

$$(i=-\infty,\cdots,-3,-2,-1,0,1,2,3,\cdots,+\infty).$$

6.3 *Big Bang in cosmos and imitated small bang*

The negative i region is quite important, where Big Bang in cosmos may happen at the possible singularity $r=0$, which is prevented from reaching as forcing to the stable bound state described under expression (108) in subsection 4.3.

To get $R^{(i)} \to R^{(-\infty)} = 0$ and form an imitated small bang, it must be done to increase the external radial force $\boldsymbol{f}_\mathrm{r}$, which equals [Ref. 7 expression (1.9.6)]

$$f_\mathrm{r} = m\left(\ddot{r} - r\dot{\theta}^2\right) \qquad \left(r = (\sqrt{2})^{(i)} R_0 \quad i = 0,-1,-2,-3,\cdots,-\infty\right) \tag{86}$$

for an intrinsically revolving zeron at the speed of $c = r\dot{\theta}$ where using polar coordinate, as large $|i|\ (i<0)$ as possible even $|i| = +\infty\ (i<0)$ to arouse Big Bang. Note that all levels with negative i are exciting states and shall automatically jump back to the stable level at R_0 [Ref: r_C in the stable bound state described under expression (65) in subsection 4.2] once the exciting factor (such as the external radial force $\boldsymbol{f}_\mathrm{r}$) is cancelled.

7 Negative energy and imaginary quantity

7.1 *square root*

If a positive direction is selected for vector $\boldsymbol{x}$, $(+\boldsymbol{x})$ indicates this positive direction while that $(-\boldsymbol{x})$ is the opposite direction. Usually real existence of physical world is using the positive direction. In $i>0$ region usually exists positive direction while negative direction is using $i<0$ region. Often $\pm x$ both are included in one x, the x maybe to be positive or negative. It is obvious that $i<0$ region is quite different from $i>0$ region. In former R goes to zero as $|i|$ increases and in latter R gets to ∞ as i increases. To distinguish positive and negative, square root is effective way. Let $\hat{\boldsymbol{e}} = \dfrac{\pm\boldsymbol{x}}{|\boldsymbol{x}|} = \pm\boldsymbol{e}$ and $|\boldsymbol{e}| = e$, then $\sqrt{e} = \sqrt{+e} = 1$ and $\sqrt{-e} = \mathrm{i}e = \mathrm{i}$. Thus the wave vector $\boldsymbol{k}$ is positive in $i>0$ region and positive in $i<0$ region. When the wave propagation is spherical wave in negative direction, must $\boldsymbol{r} \to \sqrt{(-e)\boldsymbol{r}^2} \to \mathrm{i}\boldsymbol{r}$. The replacing ω in $(\hbar\omega)$ with $(\mathrm{i}\omega)$ clearly expresses the virtual existence of negative energy where ω is the magnitude of $(\pm\omega)$ when $i<0$.

7.2 *Complex amplitude of intensity*

If $A(P,t)$ is the norm of imaginary amplitude, the intensity

$$U(P,t) = A(P)e^{\pm\mathrm{i}[\omega t - \phi(P)]} \tag{87}$$

where time part [Ref. 6:P. 144]

$$e^{\pm\mathrm{i}\omega t} = e^{[\pm\mathrm{i}\omega]t} \tag{88}$$

meeting

$$E = \hbar\omega \tag{89}$$

where $\hbar$ is Planck constant. When energy is negative as Dirac deacribed, ω must be negative and the time part

$$e^{(\pm\mathrm{i}\omega)t} = e^{\left[\pm\mathrm{i}(-\hbar\omega/\hbar)\right]t} \tag{90}$$

or

$$e^{\left[\pm\mathrm{i}(-\hbar\omega/\hbar)\right]t} \xrightarrow{E<0} e^{\mp(\mathrm{i}\omega)t} \tag{91}$$

That is to say: When energy is negative, ω becomes imaginary $\mathrm{i}\omega$, while

$$e^{\pm\mathrm{i}[\phi(P)]} \xrightarrow{\phi(P)=kr+\phi_0} e^{\pm\mathrm{i}(kr+\phi_0)} \xrightarrow{E<0} e^{\mp[k(\mathrm{i}r)+\mathrm{i}\phi_0]} \text{ (for sphericalwave)} \tag{92}$$

That is to say: When energy is negative, r becomes imaginary $\mathrm{i}r$ to meet $(\mathrm{i}\omega)(\mathrm{i}r)$=-$c$ which means the wave vector k turns to be negative (i.e. to be opposite direction).

When $\mathrm{i} \to \mathrm{i}r$, the $|b|S = |b|\varphi \xrightarrow{r\to \mathrm{i}r} |b|s/(\mathrm{i}r)$. After squaring the expression (6), it can get that when $i<0$,

$$r^{(i)} = \sqrt{a^2 - \left(|b|s/r^{(i)}\right)^2} \, (i=-1,-2,-3,\cdots<0, |b|S = \left|r^{(i-1)}\right|, a^2 = b^2, S = s/\mathrm{i}r^{(i)} \xrightarrow{>1} 1) \tag{93}$$

8 Quantum Time

For a zero-proper-mass zeron with the speed of c, space quantization inevitably leads to time quantization.

8.1 *Time quantization derived from space quantization*

We have had quantized space as

$$a = \frac{R_0}{\sqrt{2}} \tag{94}$$

and

$$R^{(i)} = \left(\sqrt{2}\right)^i R_0 \quad (i=-\infty,\cdots,-3,-2,-1,0,1,2,3,\cdots,+\infty). \tag{95}$$

For a zoren at speed of c,

$$t^{(i)} = R^{(i)}/c \quad (i=-\infty,\cdots,-3,-2,-1,0,1,2,3,\cdots,+\infty) \tag{96}$$

where t is right time and $t^{(i)}$ is the i th section of time.

8.2 *The base of zeron' mass, momentum and energy – mass m*

For a zero-proper-mass zeron, its mass m, momentum mc and energy mc^2 have a common base – mass m. This may be why gravitation related to the mass becomes essential force, As for how to apply this zronic field and its intrinsic core, especially how form various interactions, such as strong interaction, is beyond the range of this document.

As known, essential proper mass can be quantized as

$$m_0^{(i)} = \frac{m_0}{\left(\sqrt{2}\right)^i} \qquad (\, i=1,2,3,\cdots;\, m_0 = m_0^{(0)}) \tag{97}$$

together with

$$R^{(i)} = \left(\sqrt{2}\right)^i R^{(0)} = \left(\sqrt{2}\right)^i R_0 \qquad \left(i=0,1,2,\cdots,\, R^{(0)} = R_0\right). \tag{98}$$

8.3 *Time direction*

Time direction is determined by the energy order, that is, higher energy level only can be changed to lower energy levels. As seen, energy is right the representing mass. The proper mass from $i=1$ to $i=\infty$ to form a complete whole, then corresponding time direction is from $i=1$ to $i=\infty$ either. In all i region (both $i \prec 0$ and $i \succ 0$), the time direction is from $i=-\infty$ to $i=\infty$. Note that if at the energy level ordered i, all energy levels ordered as $j \geq i$ can be accepted according to level possibility. Usually the higher the energy level the higher level possibility will be, with $\frac{1}{\sqrt{2}}$ as equal ratio coefficient to guarantee a convergent series of all wave amplitude [Ref. Expression (143)].

8.4 *Natural uncertainty principle*

When $i=\infty$ only a particle can be completely determined such as its momentum ($\triangle p=0$) but this time the position departs from the beginning is $\triangle x = \triangle R = R^{(\infty)} - R^{(1)} = \infty - R^{(1)} = \infty \quad (R^{(1)} \text{ is finite})$. Or such as its energy ($\triangle E = 0$) but this time the time departs from the beginning is $\triangle t = t^{(\infty)} - t^{(1)} = R^{(\infty)}/c - R^{(1)}/c = \infty - R^{(1)}/c = \infty \quad (R^{(1)}/c \text{ is finite})$. Therefore here the uncertainty principle is quite natural and necessary. When is $t=0$? Only when $t^{(-\infty)} = R^{(-\infty)}/c = 0$.

8.5 *No space-time singularity at all*

At $r=0$, there seems to exist space-time singularity. But in zeronic field, there may be no such a space-time singularity at all. According to page 3 and expression 12,

$$a = \frac{R^{(0)}}{\sqrt{2}} = \frac{R^{(1)}}{2} = \cdots. \tag{99}$$

Thus a may be written as

$$a = \frac{R^{(i)}}{\sqrt{2}(\sqrt{2})^i} = \frac{R^{(0)}(\sqrt{2})^i}{\sqrt{2}(\sqrt{2})^i} \equiv \frac{R^{(0)}}{\sqrt{2}} = \frac{R_0}{\sqrt{2}}. \tag{100}$$

If $i=0$,

$$a = \frac{R^{(0)}}{\sqrt{2}(\sqrt{2})^0} = \frac{R^{(0)}}{\sqrt{2}}; \tag{101}$$

and if $i=1$,

$$a = \frac{R^{(1)}}{\sqrt{2}(\sqrt{2})^1} = \frac{R^{(0)}(\sqrt{2})^1}{\sqrt{2}(\sqrt{2})^1} = \frac{R^{(0)}}{\sqrt{2}}, \tag{102}$$

both established. Suppose

$$\mathrm{a} = \frac{R^{(n)}}{\sqrt{2}(\sqrt{2})^n} \tag{103}$$

is available expression, then

$$\mathrm{a}=\frac{R^{(n+1)}}{\sqrt{2}(\sqrt{2})^{n+1}}=\frac{R^{(0)}(\sqrt{2})^{n+1}}{\sqrt{2}(\sqrt{2})^{n+1}}=\frac{R^{(0)}}{\sqrt{2}}\,. \tag{104}$$

Therefore

$$a\equiv\frac{R^{(0)}}{\sqrt{2}} \tag{105}$$

sets up. When $i=-\infty$, still

$$a\equiv\frac{R_0}{\sqrt{2}}=r\,. \tag{106}$$

There is no $r=0$ can reach, also there is no space-time singularity at all. Like $R^{(1)}$, all $R^{(i)}$'s ($i>0$) are radii of curvature at a point on helix. Square the imaginary quantity is still real quantity (only will with opposite sign), so the imaginary quantity possesses like physical meaning, which is every $R^{(j)}$ ($j=-|i|<0$) is still radius of curvature from the real opinion. When $i\Rightarrow-\infty$, helix is being towards disappearance, only the a in form may pass to another helix. This is because

$$a\equiv\frac{R_0}{\sqrt{2}}=\frac{R^{(i)}}{\sqrt{2}\left(\sqrt{2}\right)^i}=\frac{R_0\left(\sqrt{2}\right)^i}{\sqrt{2}\left(\sqrt{2}\right)^i}=\frac{R_0\left(\sqrt{2}\right)^{-i}}{\sqrt{2}\left(\sqrt{2}\right)^{-i}}\overset{i<0}{=\!=\!=}\left|\mathrm{i}\frac{R^{(i)}}{\sqrt{2}\left(\sqrt{2}\right)^i}\right| \tag{107}$$

9 Photonization is light quantizaion

Square root possesses special meaning, such as

$$\sqrt{\boldsymbol{\omega}\cdot\boldsymbol{\omega}}=\sqrt{\omega^2}=|\omega|\quad(i>0) \tag{108}$$

and

$$\sqrt{\boldsymbol{R}\cdot\boldsymbol{R}}=\sqrt{R^2}=|R|\quad(i>0)\,. \tag{109}$$

In whole i region (both positive and negative),

$$\boldsymbol{\omega}\cdot\boldsymbol{\omega}=\omega^2=\sum_{i=-\infty}^{+\infty}\left(\omega^{(i)}\right)^2=\sum_{i=-\infty}^{-1}\left(\omega^{(i)}\right)^2+\left(\omega^{(0)}\right)^2+\sum_{i=1}^{+\infty}\left(\omega^{(i)}\right)^2\,, \tag{110}$$

that is

$$\sum_{i=|-1|}^{|-\infty|}\left(\mathrm{i}\frac{\omega_0}{\left(\sqrt{2}\right)^i}\right)^2+\omega_0^2+\sum_{i=1}^{+\infty}\left(\frac{\omega_0}{\left(\sqrt{2}\right)^i}\right)^2=\omega_0^2\,. \tag{111}$$

this is because

$$\begin{aligned}\sum_{i=-\infty}^{-1}\left(\omega^{(i)}\right)^2&=\sum_{i=-\infty}^{-1}\left(\mathrm{i}\frac{\omega_0}{(\sqrt{2})^i}\right)^2=-\omega_0\sum_{i=-\infty}^{-1}\left(\frac{1}{2}\right)^i\underline{\underline{|i|=-i}}-\omega_0\sum_{|i|=1}^{+\infty}\left(\frac{1}{2}\right)^{-|i|}\\&=-\omega_0\sum_{i=1}^{\infty}\left(\frac{1}{2}\right)^i=-\omega_0\end{aligned} \tag{112}$$

Similarly, $\vec{\omega}$ and $\vec{R}$ are possible vectors, may taking there dot product

$$\boldsymbol{\omega}\cdot\boldsymbol{R}=\sum_{-\infty}^{+\infty}\omega^{(i)}\cdot R^{(i)}=\sum_{-\infty}^{+\infty}(\omega\cdot R)^{(i)}=\omega_0 R_0=\text{constant.} \qquad (113)$$

Now having known the constant is the speed of light c, every definite $(\omega\cdot R)^{(i)}$ dedicates a photon. Above expression right presents quantization of light or photonization. From $-\infty$ to $+\infty$ light can reach all the space.

MSE was a theoretical discovery thirty years ago, the original of [Ref. 2: Zeronic Field and its Intrinsic Core, Planck Field Physics/New Theoretical Developments (SUB-250), SESSION 1, 0830 （001）, FRIDAY MORNING, AUGUST 5, Parallel Sessions Program] and was confirmed by practice thirteen years ago. MSE is the result of cooperation between theory and practice. To develop, MSE is developing toward utilizing ultra-large-scale integration to form passive and mineral-free energy. In the case of ST LM324 being passive, the MSE signal has been miraculously discovered, showing the possible direction of passive MSE. In the case of ST LM324 being passive, the MSE signal has been miraculously discovered, showing the possible direction of passive MSE. This is another major progress in the history of human energy development! It's totally worth looking into LM324 in depth, but this is an extremely difficult project with a difficulty similar to that of a small bang. The integration level must reach an ultra-large scale passive mineral-free, which can effectively resist electromagnetic explosions and recover all its energy. The so-called mineral-free (such as lithium) is completely forbidden to any energy-mineral. MSE itself becomes the Input Currents of chips, even though it is extremely weak, it must be continuously amplified by ultra-large-scale integration. This is another wonderful cooperation between MSE in theory and practice, but the interval of this cooperation is expected to be greatly shortened. At present, the integration degree of ultra large scale （VLSI） integrated circuits has reached 6 million transistors, with a line width of 0.3 microns, this is in the nanometer range.

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