Article

Prespacetime Model II: Genesis of Self-Referential Matrix Law, & the Ontology & Mathematics of Ether

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ABSTRACT

This work is a continuation of the prespacetime model described previously. Here we show how in this model prespacetime generates: (1) energy-momentum-mass relationship as transcendental Law of One, (2) self-referential Matrix Law with energy-momentum-mass relationship as the determinant, (3) dual-world Law of Zero and (4) immanent Law of Conservation of in the external/internal World which may be violated in certain processes. We further show how prespactime generates, sustain and makes evolving elementary particles and composite particles incorporating the genesis of self-referential Matrix Law. In addition, we discuss the ontology and mathematics of ether in this model. Illustratively, in the beginning there was prespacetime by itself $\mathbf{e}^{0}=1$ materially empty and it began to imagine through primordial self-referential spin $1=\mathbf{e}^{i0}=\mathbf{e}^{i0}\mathbf{e}^{i0}=\mathbf{e}^{iL-iL}\mathbf{e}^{iM-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{-iL}\mathbf{e}^{-iM}/\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}/\mathbf{e}^{iL}\mathbf{e}^{iM}$…such that it created the self-referential Matrix Law, the external object to be observed and internal object as observed, separated them into external world and internal world, caused them to interact through said Matrix Law and thus gave birth to the Universe which it has since sustained and made to evolve.

Key Words: prespacetime, principle of existence, spin, hierarchy, self-reference, ether, mathematics, ontology, Matrix Law, transcendental Law of One, dual-world Law of Zero, immanent Law of Conservation.

1. INTRODUCTION

Through all of us prespacetime manifests

The beauty and awe of what we continuously discover is still so ecstatic and the first author is struggling to put them in writing (also see Hu & Wu, 2001-2010). However, we as humans can only strive for perfection, completeness and correctness in our comprehensions and writings because we ourselves are limited and imperfect. As shown in our previous

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E-mail: hupinghu@quantumbrain.org Note: the models described herein are the subject of an US patent application (App. No. 12/973,633) filed with USPTO on 12/20/2010.

work and further shown here, the principles and mathematics based on prespacetime for creating, sustaining and making evolving of elementary particles and thus the Universe are beautiful and simple.

First, the prespacetime model employs the following ontological principles among others are :

(1) Principle of oneness/unity of existence through quantum entanglement in the ether of prespacetime.

(2) Principle of hierarchical primordial self-referential spin creating:

- Energy-momentum-mass relationship as transcendental Law of One
- Energy-momentum-mass relationship as determinant of Matrix Law
- Dual-world Law of Zero of energy, momentum & mass
- Immanent Law of Conservation of energy, momentum & mass in external/internal world which may be violated in certain processes

Second, prespacetime model employs the following mathematical elements & forms among others in order to empower the above ontological principles among others:

(1) *e*, Euler's number, for (to empower) ether (aether) as foundation/basis/medium of existence (body of prespacetime);
(2) *i*, imaginary number, for (to empower) thoughts and imagination;
(3) 0, zero, for (to empower) emptiness/undifferentiated/primordial state;
(4) 1, one, for (to empower) oneness/unity of existence;
(5) +, -, *, /, = for (to empower) creation, dynamics, balance & conservation;
(6) Pythagorean theorem for (to empower) Energy-Momentum-Mass Relationship; and
(7) *M*, matrix, for (to empower) the external and internal worlds (the Dual World) and the interaction of external and internal worlds.

This work is organized as follows. In § 2, we shall illustrate scientific genesis in a nutshell which incorporates the genesis of self-referential Matrix Law. In § 3, we shall detail the genesis of self-referential Matrix Law in the order of: (1) Genesis of Fundamental Energy, Momentum & Mass Relationship; (2) Self-Referential Matrix Law and Its Metamorphoses; (3) Imaginary Momentum; (4) Games for Deriving Matrix Law; and (5) Hierarchical Natural Laws. In § 4, we shall incorporate the genesis of self-referential Matrix Law into scientific genesis of primordial entities (elementary particles) and scientific genesis of composite entities. In § 5, we shall show the mathematics and ontology of ether in the prespacetime model. Finally, in § 6, we shall conclude this work. §6 are followed by a dedication and [self-]references.

2. SCIENTIFIC GENESIS IN A NUTSHELL

Prespacetime Model Creates Everything
By Self-referential Spin

In the beginning there was prespacetime by itself $\mathbf{e}^0 = 1$ materially empty and it began to imagine through primordial self-referential spin $1=\mathbf{e}^{i0}=\mathbf{e}^{i0}\mathbf{e}^{i0}=\mathbf{e}^{iL-iL}\mathbf{e}^{iM-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{-iL}\mathbf{e}^{-iM}/\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}/\mathbf{e}^{iL}\mathbf{e}^{iM}$…such that it created the self-referential Matrix Law, the external object to be observed and internal object as observed, separated them into external world and internal world, caused them to interact through said Matrix Law and thus gave birth to the Universe which it has since sustained and made to evolve.

We draw below several diagrams illustrating the above processes:

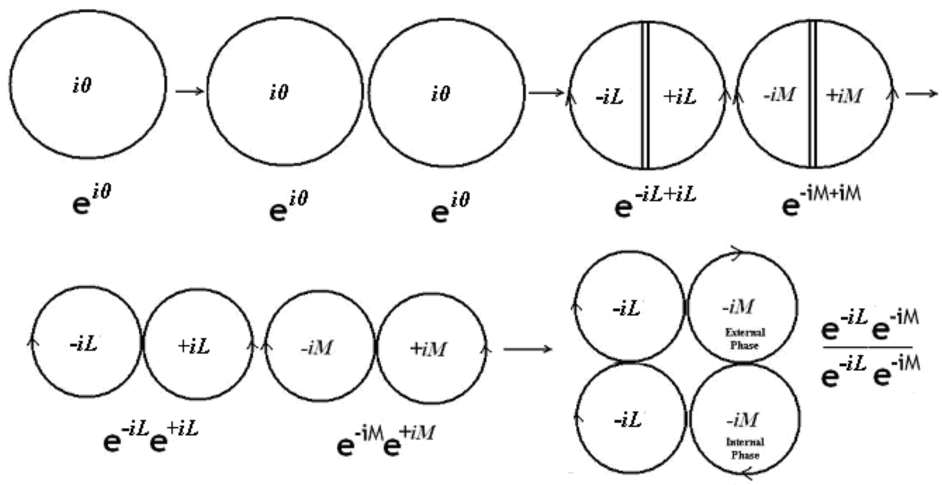

Figure 2.1 Illustration of primordial phase distinction

The primordial phase distinction in Figure 2.1 is accompanied by matrixing of prespacetime body **e** into: (1) external and internal wave functions as external and internal objects, and (2) self-acting and self-referential Matrix Law, which accompany the imaginations in prespacetime so as to enforce (maintain) the accounting principle of conservation of zero, as illustrated in Figure 2.2.

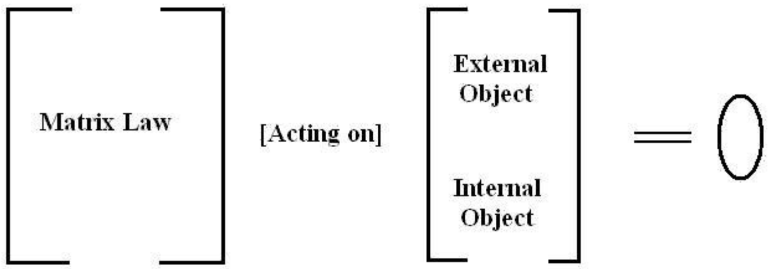

Figure2.2 Prespacetime Equation

Figure 2.3 shows from another perspective of the relationship among external object, internal object and the self-acting and self-referential Matrix Law. According to prespacetime model, self-interactions (self-gravity) are quantum entanglement between the external object and the internal object.

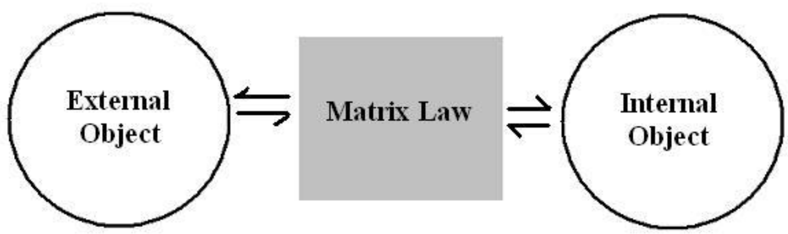

Figure2.3 Self-interaction between external and internal objects

Therefore, prespacetime model creates, sustains and causes evolution of primordial entities (elementary particles) in prespacetime by self-referential spin as follows:

$$1 = e^{i0} = e^{i0}e^{i0} = e^{-iL+iL}e^{-iM+iM} = L_e L_i^{-1}\left(e^{-iM}\right)\left(e^{-iM}\right)^{-1} \rightarrow$$
$$\begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} A_e e^{-iM} \\ A_i e^{-iM} \end{pmatrix} = L_M \begin{pmatrix} A_e \\ A_i \end{pmatrix} e^{-iM} = L_M \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = L_M \psi = 0 \quad (2.1)$$

In expression (2.1), *e* is Euler number representing prespacetime body (ether or aether), *i* is imaginary unit representing imagination in prespacetime, $\pm M$ is immanent content of imagination *i* such as space, time, momentum & energy, $\pm L$ is immanent law of imagination *i*, $L_1 = e^{i0} = e^{-iL+iL} = L_e L_i^{-1} = 1$ is transcendental Law of One in prespacetime before matrixization, L_e is external law, L_i is internal law, $L_{M,e}$ is external matrix law, and $L_{M,i}$ is internal matrix law, L_M is the self-referential Matrix Law in prespacetime comprised of external and internal matrix laws which governs elementary entities and conserves zero, Ψ_e is external wave function (external object), Ψ_i is internal wave function (internal object)and Ψ is the complete wave function (object/entity in the dual-world as a whole).

Prespacetime spins as $1=\mathbf{e}^{i0}=\mathbf{e}^{i0}\mathbf{e}^{i0}=\mathbf{e}^{iL\text{-}iL}\mathbf{e}^{iM\text{-}iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{-iL}\mathbf{e}^{-iM}/\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}/\mathbf{e}^{iL}\mathbf{e}^{iM}\ldots$ before matrixization. Prespacetime also spins through self-acting and self-referential Matrix Law L_M after matrixization which acts on external object and internal object to cause them to interact with each other as further described below.

3. GENESIS OF SELF-REFERENTIAL MATRIX LAW

Natural laws are hierarchical

3.1 Genesis of Fundamental Energy, Momentum & Mass Relationship

In the prespacetime model, fundamental energy, momentum & mass relationship:

$$E^2 = m^2 + \mathbf{p}^2 \quad \text{or} \quad E^2 - m^2 - \mathbf{p}^2 = 0 \qquad (3.1)$$

is created from the following primordial self-referential spin:

$$1 = e^{i0} = e^{-iL+iL} = L_e L_i^{-1} = (\cos L - i\sin L)(\cos L + i\sin L) =$$
$$\left(\frac{m}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E} + i\frac{|\mathbf{p}|}{E}\right) = \left(\frac{m - i|\mathbf{p}|}{E}\right)\left(\frac{m + i|\mathbf{p}|}{E}\right) = \left(\frac{m^2 + \mathbf{p}^2}{E^2}\right) \rightarrow$$
$$E^2 = m^2 + \mathbf{p}^2 \qquad (3.2)$$

For simplicity, we have set c=1 in equation (3.4) and will set $c=\hbar=1$ through out this work unless indicated otherwise. Expression (3.4) was discovered by Einstein.

In the presence of an interacting field of a second primordial entity such as an electromagnetic potential:

$$A^{\mu} = (\phi, \mathbf{A}) \qquad (3.3)$$

equation (3.4) becomes for an elementary entity with electric charge e:

$$1=e^{i0}=e^{-iL+iL}=L_eL_i^{-1}=(\cos L-i\sin L)(\cos L+i\sin L)=$$
$$\left(\frac{m}{E-e\phi}-i\frac{|\mathbf{p}\text{ - }e\mathbf{A}|}{E-e\phi}\right)\left(\frac{m}{E-e\phi}+i\frac{|\mathbf{p}\text{ - }e\mathbf{A}|}{E-e\phi}\right)=$$
$$\left(\frac{m-i|\mathbf{p}\text{ - }e\mathbf{A}|}{E-e\phi}\right)\left(\frac{m+i|\mathbf{p}\text{ - }e\mathbf{A}|}{E-e\phi}\right)=\left(\frac{m^2+|\mathbf{p}\text{ - }e\mathbf{A}|^2}{(E-e\phi)^2}\right)\rightarrow$$
$$(E-e\phi)^2=m^2+(\mathbf{p}\text{ - }e\mathbf{A})^2 \text{ or } (E-e\phi)^2-m^2-(\mathbf{p}\text{ - }e\mathbf{A})^2=0 \quad (3.4)$$

3.2 Self-Referential Matrix Law and Its Metamorphoses

In the prespacetime model, one form of Matrix Law L_M in prespacetime is created from the following primordial self-referential spin:

$$1=e^{i0}=e^{-iL+iL}=L_eL_i^{-1}=(\cos L-i\sin L)(\cos L+i\sin L)=$$
$$\left(\frac{m}{E}-i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E}+i\frac{|\mathbf{p}|}{E}\right)=\left(\frac{m-i|\mathbf{p}|}{E}\right)\left(\frac{m+i|\mathbf{p}|}{E}\right)=\left(\frac{m^2+\mathbf{p}^2}{E^2}\right)$$
$$=\frac{E^2-m^2}{\mathbf{p}^2}=\left(\frac{E-m}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E+m}\right)^{-1}$$
$$\rightarrow\frac{E-m}{-|\mathbf{p}|}=\frac{-|\mathbf{p}|}{E+m}\rightarrow\frac{E-m}{-|\mathbf{p}|}-\frac{-|\mathbf{p}|}{E+m}=0 \quad (3.5)$$
$$\rightarrow\begin{pmatrix}E-m & -|\mathbf{p}|\\ -|\mathbf{p}| & E+m\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}=L_M$$

where matrixization step is carried out in such way that

$$\text{Det}(L_M)=E^2-m^2-\mathbf{p}^2=0 \quad (3.6)$$

so as to satisfy the fundamental relationship (3.4) in the determinant view.

After fermionic spinization:

$$|\mathbf{p}|=\sqrt{\mathbf{p}^2}=\sqrt{-Det(\boldsymbol{\sigma}\cdot\mathbf{p})}\rightarrow\boldsymbol{\sigma}\cdot\mathbf{p} \quad (3.7)$$

where $\boldsymbol{\sigma} = (\sigma_1, \sigma_2, \sigma_3)$ are Pauli matrices:

$$\sigma_1 = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad \sigma_2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \quad \sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \tag{3.8}$$

expression (3.7) becomes:

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M = E - \boldsymbol{\alpha} \bullet \mathbf{p} - \beta \mathrm{m} = E - H \tag{3.9}$$

where $\boldsymbol{\alpha} = (\alpha_1, \alpha_2, \alpha_3)$ and β are Dirac matrices and $H = \boldsymbol{\alpha}\bullet\mathbf{p} + \beta\mathrm{m}$ is the Dirac Hamiltonian. Expression (3.12) governs fermions in Dirac form such as Dirac electron and positron and we propose that expression (3.7) governs the third state of matter (unspinized or spinless entity/particle) with electric charge *e* and mass *m* such as a meson or a meson-like particle.

If we define:

$$Det_\sigma \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} = (E-m)(E+m) - (-\boldsymbol{\sigma}\cdot\mathbf{p})(-\boldsymbol{\sigma}\cdot\mathbf{p}) \tag{3.10}$$

We get:

$$Det_\sigma \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} = \left(E^2 - m^2 - \mathbf{p}^2\right) I_2 = 0 \tag{3.11}$$

Thus, fundamental relationship (3.1) is also satisfied under the determinant view of expression (3.13). Indeed, we can also obtain the following conventional determinant:

$$Det \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} = \left(E^2 - m^2 - \mathbf{p}^2\right)^2 = 0 \tag{3.12}$$

One kind of metamorphosis of expressions (3.5), (3.9), (310) & (3.11) is respectively as follows:

$$1 = e^{i0} = e^{-iL+iL} = L_e L_i^{-1} = (\cos L - i\sin L)(\cos L + i\sin L) =$$
$$\left(\frac{m}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E} + i\frac{|\mathbf{p}|}{E}\right) = \left(\frac{m - i|\mathbf{p}|}{E}\right)\left(\frac{m + i|\mathbf{p}|}{E}\right) = \left(\frac{m^2 + \mathbf{p}^2}{E^2}\right) =$$

$$\frac{E^2-\mathbf{p}^2}{m^2}=\left(\frac{E-|\mathbf{p}|}{-m}\right)\left(\frac{-m}{E+|\mathbf{p}|}\right)^{-1}\rightarrow$$
$$\rightarrow\frac{E-|\mathbf{p}|}{-m}=\frac{-m}{E+|\mathbf{p}|}\rightarrow\frac{E-|\mathbf{p}|}{-m}-\frac{-m}{E+|\mathbf{p}|}=0 \qquad (3.13)$$
$$\begin{pmatrix}E-|\mathbf{p}| & -m\\ -m & E+|\mathbf{p}|\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}=L_M$$

$$\begin{pmatrix}E-\boldsymbol{\sigma}\cdot\mathbf{p} & -m\\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}=L_M \qquad (3.14)$$

$$Det_\sigma\begin{pmatrix}E-\boldsymbol{\sigma}\cdot\mathbf{p} & -m\\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}\end{pmatrix}=(E-\boldsymbol{\sigma}\cdot\mathbf{p})(E+\boldsymbol{\sigma}\cdot\mathbf{p})-(-m)(-m) \qquad (3.15)$$

$$Det_\sigma\begin{pmatrix}E-\boldsymbol{\sigma}\cdot\mathbf{p} & -m\\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}\end{pmatrix}=\left(E^2-\mathbf{p}^2-m^2\right)I_2=0 \qquad (3.16)$$

The last expression in (3.13) is the unspinized Matrix Law in Weyl (chiral) form. Expression (3.14) is spinized Matrix Law in Weyl (chiral) form.

Another kind of metamorphosis of expressions (3.5), (3.9), (310) & (3.11) is respectively as follows:

$$1=e^{i0}=e^{-iL+iL}=L_eL_i^{-1}=(\cos L-i\sin L)(\cos L+i\sin L)=$$
$$\left(\frac{m}{E}-i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E}+i\frac{|\mathbf{p}|}{E}\right)=\left(\frac{m-i|\mathbf{p}|}{E}\right)\left(\frac{m+i|\mathbf{p}|}{E}\right)=\left(\frac{E}{-m+i|\mathbf{p}|}\right)^{-1}\left(\frac{-m-i|\mathbf{p}|}{E}\right) \qquad (3.17)$$
$$\rightarrow\frac{E}{-m+i|\mathbf{p}|}=\frac{-m-i|\mathbf{p}|}{E}\rightarrow\frac{E}{-m+i|\mathbf{p}|}-\frac{-m-i|\mathbf{p}|}{E}=0$$
$$\rightarrow\begin{pmatrix}E & -m-i|\mathbf{p}|\\ -m+i|\mathbf{p}| & E\end{pmatrix}=\begin{pmatrix}L_e & L_i\end{pmatrix}=L_M$$

$$\begin{pmatrix}E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p}\\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p} & E\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}=L_M \qquad (3.18)$$

$$Det_\sigma\begin{pmatrix}E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p}\\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p} & E\end{pmatrix}=EE-(-m-i\boldsymbol{\sigma}\cdot\mathbf{p})(-m+i\boldsymbol{\sigma}\cdot\mathbf{p}) \qquad (3.19)$$

$$Det_{\sigma}\begin{pmatrix} E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} = \left(E^2 - m^2 - \mathbf{p}^2\right)I_2 = 0 \qquad (3.20)$$

Indeed, $Q = m + i\boldsymbol{\sigma}\cdot\mathbf{p}$ is a quaternion and $Q^* = m - i\boldsymbol{\sigma}\cdot\mathbf{p}$ is its conjugate. So we can rewrite expression (3.29) as:

$$\begin{pmatrix} E & -Q \\ -Q^* & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \qquad (3.21)$$

If m=0, we have from expression (3.5):

$$\begin{gathered} 1 = e^{i0} = e^{-iL+iL} = L_e L_i^{-1} = (\cos L - i\sin L)(\cos L + i\sin L) = \\ \left(\frac{0}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{0}{E} + i\frac{|\mathbf{p}|}{E}\right) = \left(-i\frac{|\mathbf{p}|}{E}\right)\left(+i\frac{|\mathbf{p}|}{E}\right) = \left(\frac{\mathbf{p}^2}{E^2}\right) \\ = \frac{E^2}{\mathbf{p}^2} = \left(\frac{E}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E}\right)^{-1} \\ \rightarrow \frac{E}{-|\mathbf{p}|} = \frac{-|\mathbf{p}|}{E} \rightarrow \frac{E}{-|\mathbf{p}|} - \frac{-|\mathbf{p}|}{E} = 0 \\ \rightarrow \begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \end{gathered} \qquad (3.22)$$

After fermionic spinization $|\mathbf{p}| \rightarrow \boldsymbol{\sigma}\cdot\mathbf{p}$, the last expression in (3.22) becomes:

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \qquad (3.23)$$

which governs massless fermion (neutrino) in Dirac form.

After bosonic spinization:

$$|\mathbf{p}| = \sqrt{\mathbf{p}^2} = \sqrt{-\left(Det(\mathbf{s}\cdot\mathbf{p}+I_3) - Det(I_3)\right)} \rightarrow \mathbf{s}\cdot\mathbf{p} \qquad (3.24)$$

the expression in (3.22) becomes:

$$\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.25}$$

where **s** = (s_1, s_2, s_3) are spin operators for spin 1 particle:

$$s_1 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & -i \\ 0 & i & 0 \end{pmatrix} \quad s_2 = \begin{pmatrix} 0 & 0 & i \\ 0 & 0 & 0 \\ -i & 0 & 0 \end{pmatrix} \quad s_3 = \begin{pmatrix} 0 & -i & 0 \\ i & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \tag{3.26}$$

If we define:

$$Det_s \begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} = (E)(E) - (-\mathbf{s}\cdot\mathbf{p})(-\mathbf{s}\cdot\mathbf{p}) \tag{3.27}$$

We get:

$$Det_s \begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} = \left(E^2 - \mathbf{p}^2\right) I_3 - \begin{pmatrix} p_x^2 & p_x p_y & p_x p_z \\ p_y p_x & p_y^2 & p_y p_z \\ p_z p_x & p_z p_y & p_z^2 \end{pmatrix} \tag{3.28}$$

To obey fundamental relationship (3.1) in determinant view (3.27), we shall require the last term in (3.28) acting on the external and internal wave functions respectively to produce null result (zero) in source-free zone as discussed later. We propose that the last expression in (3.22) governs massless particle with unobservable spin (spinless). After bosonic spinization, the spinless and massless particle gains its spin 1.

Further, if |**p**|=0, we have:

$$1 = e^{i0} = e^{-iL+iL} = L_e L_i^{-1} = (\cos L - i\sin L)(\cos L + i\sin L) =$$
$$\left(\frac{m}{E} - i\frac{0}{E}\right)\left(\frac{m}{E} + i\frac{0}{E}\right) = \left(\frac{m}{E}\right)\left(\frac{m}{E}\right) = \left(\frac{m^2}{E^2}\right)$$

$$= \frac{E^2}{m^2} = \left(\frac{E}{-m}\right)\left(\frac{-m}{E}\right)^{-1}$$
$$\rightarrow \frac{E}{-m} = \frac{-m}{E} \rightarrow \frac{E}{-m} - \frac{-m}{E} = 0 \qquad (3.29)$$
$$\rightarrow \begin{pmatrix} E & -m \\ -m & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M$$

We suggest the above spaceless forms of Matrix Law govern the external and internal wave functions (self-fields) which play the roles of spaceless gravitons, that is, they mediate space (distance) independent interactions through proper time (mass) entanglement.

3.3 Imaginary Momentum

Prespacetime model creates spatial self-confinement of an elementary entity through imaginary momentum $\mathbf{p}_i$ (downward self-reference such that $m^2>E^2$):

$$m^2 - E^2 = -\mathbf{p}_i^2 = -p_{i,1}^2 - p_{i,2}^2 - p_{i,3}^2 = (i\mathbf{p}_i)^2 = -Det(\boldsymbol{\sigma} \cdot i\mathbf{p}_i) \qquad (3.30)$$

that is:

$$E^2 - m^2 - \mathbf{p}_i^2 = 0 \qquad (3.31)$$

which can be created by the following primordial self-referential spin:

$$1 = e^{i0} = e^{-iL+iL} = L_e L_i^{-1} = (\cos L - i\sin L)(\cos L + i\sin L) =$$
$$\left(\frac{m}{E} - i\frac{|\mathbf{p}_i|}{E}\right)\left(\frac{m}{E} + i\frac{|\mathbf{p}_i|}{E}\right) = \left(\frac{m - i|\mathbf{p}_i|}{E}\right)\left(\frac{m + i|\mathbf{p}_i|}{E}\right) = \left(\frac{m^2 + \mathbf{p}_i^{\ 2}}{E^2}\right) \rightarrow$$
$$E^2 = m^2 + \mathbf{p}_i^{\ 2} \ \text{ or } \ E^2 - m^2 - \mathbf{p}_i^{\ 2} = 0 \qquad (3.32)$$

Therefore, allowing imaginary momentum (downward self-reference) for an elementary entity, we can derive the following Matrix Law in Dirac-like form:

$$\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \qquad (3.33)$$

$$\begin{pmatrix} -m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i \\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & +m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \qquad (3.34)$$

Also, we can derive the following Matrix Law in Weyl-like (chiral-like) form:

$$\begin{pmatrix} E-|\mathbf{p}_i| & -m \\ -m & +|\mathbf{p}_i| \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.35}$$

$$\begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.36}$$

It is suggested that the above additional forms of self-referential Matrix Law govern proton in Dirac and Weyl form respectively.

3.4 Games for Deriving Matrix Law

The games for deriving various forms of the Matrix Law prior to spinization can be summarized as follows:

$$\begin{aligned} 0 = E^2 - m^2 - \mathbf{p}^2 &= \left(DetM_E + DetM_m + DetM_p\right) \\ &= Det(M_E + M_m + M_p) = Det(L_M) \end{aligned} \tag{3.37}$$

where *Det* means determinant and M_E, M_m and M_p are respectively matrices with $\pm E$ (or $\pm iE$), $\pm m$ (or $\pm im$) and $\pm|\mathbf{p}|$ (or $\pm i|\mathbf{p}|$) as elements respectively, and E^2, $-m^2$ and $-\mathbf{p}^2$ as determinant respectively, and L_M is the Matrix Law so derived.

For example, the Matrix Law in Dirac form prior to spinization:

$$L_M = \begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} \tag{3.38}$$

can be derived as follows:

$$0 = E^2 - m^2 - \mathbf{p}^2 = Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + Det\begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix} =$$

$$Det\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + \begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix}\right) = Det\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} = Det(L_M) \tag{3.39}$$

For a second example, the Matrix Law in Weyl form prior to spinization:

$$L_M = \begin{pmatrix} E-|\mathbf{p}| & -m \\ -m & E+|\mathbf{p}| \end{pmatrix} \tag{3.40}$$

can be derived as follows:

$$0 = E^2 - m^2 - \mathbf{p}^2 = Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + Det\begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix} =$$

$$Det\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + \begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix}\right) = Det\begin{pmatrix} E-|\mathbf{p}| & -m \\ -m & E+|\mathbf{p}| \end{pmatrix} = Det(L_M) \tag{3.41}$$

For a third example, the Matrix Law in Quaternion form prior to spinization:

$$L_M = \begin{pmatrix} E & -m-i|\mathbf{p}| \\ -m+i|\mathbf{p}| & E \end{pmatrix} \tag{3.42}$$

can be derived as follows:

$$0 = E^2 - m^2 - \mathbf{p}^2 = Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + Det\begin{pmatrix} 0 & -i|\mathbf{p}| \\ i|\mathbf{p}| & 0 \end{pmatrix} =$$

$$Det\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + \begin{pmatrix} 0 & -i|\mathbf{p}| \\ i|\mathbf{p}| & 0 \end{pmatrix}\right) = Det\begin{pmatrix} E & -m-i|\mathbf{p}| \\ -m+i|\mathbf{p}| & E \end{pmatrix} = Det(L_M) \tag{3.43}$$

3.5 Hierarchical Natural Laws

The Natural laws created in accordance with the prespacetime model are hierarchical and comprised of: (1) immanent Law of Conservation manifesting and governing in the external or internal world which may be violated in certain processes; (2) immanent Law of Zero manifesting and governing in the dual world as a whole; and (3) transcendental Law of One manifesting and governing in prespacetime. By ways of examples, conservations of energy, momentum and mass are immanent (and approximate) laws manifesting and governing in the external or internal world. Conservations of energy, momentums or mass to zero in the dual world comprised of the external world and internal world are immanent law manifesting and governing in the dual world as a whole. Conservation of One (Unity) based on Energy-Momentum- Mass Relationship is transcendental law manifesting and governing in prespacetime which is the foundation of external world and internal world.

4. SCIENTIFIC GENESIS OF ELEMENTARY PARTICLES

In the beginning External & Internal Objects
& the governing Matrix Law were created in Prespacetime

4.1 Scientific Genesis of Primordial Entities (Elementary Particles)

Prespacetime model creates, sustains and causes evolution of a free plane-wave fermion such as an electron in Dirac form as follows:

$$
\begin{aligned}
1 = e^{i0} = e^{i0}e^{i0} &= e^{-iL+iL}e^{-iM+iM} \\
(\cos L - i\sin L)(\cos L + i\sin L)e^{-iM+iM} &= \\
\left(\frac{m}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E} + i\frac{|\mathbf{p}|}{E}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} & \\
= \left(\frac{m - i|\mathbf{p}|}{E}\right)\left(\frac{m + i|\mathbf{p}|}{E}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} & \\
= \left(\frac{m^2 + \mathbf{p}^2}{E^2}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} = \frac{E^2 - m^2}{\mathbf{p}^2}e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} & \\
= \left(\frac{E-m}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E+m}\right)^{-1}\left(e^{-ip^{\mu}x_{\mu}}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow &
\end{aligned}
\tag{4.1}
$$

$$
\frac{E-m}{-|\mathbf{p}|}e^{-ip^{\mu}x_{\mu}} = \frac{-|\mathbf{p}|}{E+m}e^{-ip^{\mu}x_{\mu}} \rightarrow \frac{E-m}{-|\mathbf{p}|}e^{-ip^{\mu}x_{\mu}} - \frac{-|\mathbf{p}|}{E+m}e^{-ip^{\mu}x_{\mu}} = 0
$$

$$
\rightarrow \begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} a_{e,+}e^{-ip^{\mu}x_{\mu}} \\ a_{i,-}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = L_M\psi = 0
$$

$$
\rightarrow \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix}\begin{pmatrix} A_{e,+}e^{-ip^{\mu}x_{\mu}} \\ A_{i,-}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = L_M\psi = 0
$$

that is:

$$
\begin{pmatrix} (E-m)\psi_{e,+} = \boldsymbol{\sigma}\cdot\mathbf{p}\,\psi_{i,-} \\ (E+m)\psi_{i,-} = \boldsymbol{\sigma}\cdot\mathbf{p}\,\psi_{e,+} \end{pmatrix} \text{ or } \begin{pmatrix} i\partial_t\psi_{e,+} - m\psi_{e,+} = -i\boldsymbol{\sigma}\cdot\nabla\psi_{i,-} \\ i\partial_t\psi_{i,-} + m\psi_{i,-} = -i\boldsymbol{\sigma}\cdot\nabla\psi_{e,+} \end{pmatrix}
\tag{4.2}
$$

where substitutions $E \rightarrow i\partial_t$ and $\mathbf{p} \rightarrow -i\nabla$ have been made so that components of L_M can act on external and internal wave functions.

Prespacetime model creates, sustains and causes evolution of a free plane-wave antifermion such as a positron in Dirac form as follows:

$$1 = e^{i0} = e^{i0}e^{i0} = e^{+iL-iL}e^{+iM-iM}$$

$$(\cos L + i\sin L)(\cos L - i\sin L)e^{+iM-iM} =$$

$$\left(\frac{m}{E} + i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E} - i\frac{|\mathbf{p}|}{E}\right)e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}}$$

$$= \left(\frac{m+i|\mathbf{p}|}{E}\right)\left(\frac{m-i|\mathbf{p}|}{E}\right)e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}}$$

$$= \left(\frac{m^2+\mathbf{p}^2}{E^2}\right)e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}} = \frac{E^2-m^2}{\mathbf{p}^2}e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}}$$

$$= \left(\frac{E-m}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E+m}\right)^{-1}\left(e^{+ip^{\mu}x_{\mu}}\right)\left(e^{+ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow \tag{4.3}$$

$$\frac{E-m}{-|\mathbf{p}|}e^{+ip^{\mu}x_{\mu}} = \frac{-|\mathbf{p}|}{E+m}e^{+ip^{\mu}x_{\mu}} \rightarrow \frac{E-m}{-|\mathbf{p}|}e^{+ip^{\mu}x_{\mu}} - \frac{-|\mathbf{p}|}{E+m}e^{+ip^{\mu}x_{\mu}} = 0$$

$$\rightarrow \begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} a_{e,-}e^{+ip^{\mu}x_{\mu}} \\ a_{i,+}e^{+ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = L_M\psi = 0$$

$$\rightarrow \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix}\begin{pmatrix} A_{e,-}e^{+ip^{\mu}x_{\mu}} \\ A_{i,+}e^{+ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = L_M\psi = 0$$

Similarly, in the principle of existence, Consciousness creates, sustains and causes evolution of a free plane-wave fermion in Weyl (chiral) form as follows:

$$1 = e^{i0} = e^{i0}e^{i0} = e^{-iL+iL}e^{-iM+iM}$$

$$(\cos L - i\sin L)(\cos L + i\sin L)e^{-iM+iM} =$$

$$\left(\frac{m}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E} + i\frac{|\mathbf{p}|}{E}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}}$$

$$=\left(\frac{m-i|\mathbf{p}|}{E}\right)\left(\frac{m+i|\mathbf{p}|}{E}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}}$$

$$=\left(\frac{m^2+\mathbf{p}^2}{E^2}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}}=\frac{E^2-\mathbf{p}^2}{m^2}e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}}$$

$$=\left(\frac{E-|\mathbf{p}|}{-m}\right)\left(\frac{-m}{E+|\mathbf{p}|}\right)^{-1}\left(e^{-ip^{\mu}x_{\mu}}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)^{-1}\rightarrow \qquad (4.4)$$

$$\frac{E-|\mathbf{p}|}{-m}e^{-ip^{\mu}x_{\mu}}=\frac{-m}{E+|\mathbf{p}|}e^{-ip^{\mu}x_{\mu}}\rightarrow\frac{E-|\mathbf{p}|}{-m}e^{-ip^{\mu}x_{\mu}}-\frac{-m}{E+|\mathbf{p}|}e^{-ip^{\mu}x_{\mu}}=0$$

$$\rightarrow\begin{pmatrix}E-|\mathbf{p}| & -m\\ -m & E+|\mathbf{p}|\end{pmatrix}\begin{pmatrix}a_{e,l}e^{-ip^{\mu}x_{\mu}}\\ a_{i,r}e^{-ip^{\mu}x_{\mu}}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,l}\\ \psi_{i,r}\end{pmatrix}=L_M\psi=0$$

$$\rightarrow\begin{pmatrix}E-\boldsymbol{\sigma}\cdot\mathbf{p} & -m\\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}\end{pmatrix}\begin{pmatrix}A_{e,l}e^{-ip^{\mu}x_{\mu}}\\ A_{i,r}e^{-ip^{\mu}x_{\mu}}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,l}\\ \psi_{i,r}\end{pmatrix}=L_M\psi=0$$

that is:

$$\begin{pmatrix}(E-\boldsymbol{\sigma}\cdot\mathbf{p})\psi_{e,l}=m\psi_{i,r}\\ (E+\boldsymbol{\sigma}\cdot\mathbf{p})\psi_{i,r}=m\psi_{e,l}\end{pmatrix}\quad\text{or}\quad\begin{pmatrix}i\partial_t\psi_{e,l}+i\boldsymbol{\sigma}\cdot\nabla\psi_{e,l}=m\psi_{i,r}\\ i\partial_t\psi_{i,r}-i\boldsymbol{\sigma}\cdot\nabla\psi_{i,-}=m\psi_{e,l}\end{pmatrix} \qquad (4.5)$$

Prespacetime model creates, sustains and causes evolution of a free plane-wave fermion in another form as follows:

$$1=e^{i0}=e^{i0}e^{i0}=e^{-iL+iL}e^{-iM+iM}$$

$$(\cos L-i\sin L)(\cos L+i\sin L)e^{-iM+iM}=$$

$$\left(\frac{m}{E}-i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E}+i\frac{|\mathbf{p}|}{E}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}}$$

$$=\left(\frac{m-i|\mathbf{p}|}{E}\right)\left(\frac{m+i|\mathbf{p}|}{E}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} \qquad (4.6)$$

$$=\left(\frac{E}{-m+i\varepsilon|\mathbf{p}|}\right)\left(\frac{-m-i|\mathbf{p}|}{E}\right)^{-1}\left(e^{-ip^{\mu}x_{\mu}}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)^{-1}$$

$$\rightarrow \frac{E}{-m+i|\mathbf{p}|} e^{-ip^{\mu}x_{\mu}} = \frac{-m-i|\mathbf{p}|}{E} e^{-ip^{\mu}x_{\mu}}$$

$$\rightarrow \frac{E}{-m+i|\mathbf{p}|} e^{-ip^{\mu}x_{\mu}} - \frac{-m-i|\mathbf{p}|}{E} e^{-ip^{\mu}x_{\mu}} = 0$$

$$\rightarrow \begin{pmatrix} E & -m-i|\mathbf{p}| \\ -m+i|\mathbf{p}| & E \end{pmatrix} \begin{pmatrix} a_e e^{-ip^{\mu}x_{\mu}} \\ a_i e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = L_M \psi = 0$$

$$\rightarrow \begin{pmatrix} E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{-ip^{\mu}x_{\mu}} \\ A_i e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = L_M \psi = 0$$

$$\rightarrow \begin{pmatrix} E & -Q \\ -Q^* & E \end{pmatrix} \begin{pmatrix} A_e e^{-ip^{\mu}x_{\mu}} \\ A_i e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = L_M \psi = 0$$

(where $Q = m + i\boldsymbol{\sigma}\cdot\mathbf{p}$ is a quaternion and $Q^* = m - i\boldsymbol{\sigma}\cdot\mathbf{p}$ is its conjugate)

that is:

$$\begin{pmatrix} E\psi_e = (m + i\boldsymbol{\sigma}\cdot\mathbf{p})\psi_i \\ E\psi_i = (m - i\boldsymbol{\sigma}\cdot\mathbf{p})\psi_e \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} i\partial_t\psi_e = m\psi_i + \boldsymbol{\sigma}\cdot\nabla\psi_i \\ i\partial_t\psi_i = m\psi_e - \boldsymbol{\sigma}\cdot\nabla\psi_i \end{pmatrix} \qquad (4.7)$$

Prespacetime model creates, sustains and causes evolution of a linear plane-wave photon as follows:

$$1 = e^{i0} = e^{i0}e^{i0} = e^{-iL+iL}e^{-iM+iM}$$

$$(\cos L - i\sin L)(\cos L + i\sin L)e^{-iM+iM} =$$

$$\left(\frac{0}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{0}{E} + i\frac{|\mathbf{p}|}{E}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}}$$

$$= \left(-i\frac{|\mathbf{p}|}{E}\right)\left(+i\frac{|\mathbf{p}|}{E}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} \qquad (4.8)$$

$$\left(\frac{\mathbf{p}^2}{E^2}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} = \left(\frac{E^2}{\mathbf{p}^2}\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} =$$

$$\left(\frac{E}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E}\right)^{-1}\left(e^{-ip^{\mu}x_{\mu}}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow$$

$$\frac{E}{-|\mathbf{p}|}e^{-ip^{\mu}x_{\mu}}=\frac{-|\mathbf{p}|}{E}e^{-ip^{\mu}x_{\mu}}\rightarrow\frac{E}{-|\mathbf{p}|}e^{-ip^{\mu}x_{\mu}}-\frac{-|\mathbf{p}|}{E}e^{-ip^{\mu}x_{\mu}}=0$$

$$\rightarrow\begin{pmatrix}E & -|\mathbf{p}|\\ -|\mathbf{p}| & E\end{pmatrix}\begin{pmatrix}a_{e,+}e^{-ip^{\mu}x_{\mu}}\\ a_{i,-}e^{-ip^{\mu}x_{\mu}}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,+}\\ \psi_{i,-}\end{pmatrix}=L_{M}\psi=0$$

$$\rightarrow\begin{pmatrix}E & -\mathbf{s}\cdot\mathbf{p}\\ -\mathbf{s}\cdot\mathbf{p} & E\end{pmatrix}\begin{pmatrix}\mathrm{E}_{0e,+}e^{-ip^{\mu}x_{\mu}}\\ i\mathrm{B}_{0i,-}e^{-ip^{\mu}x_{\mu}}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,+}\\ \psi_{i,-}\end{pmatrix}=L_{M}\psi_{photon}=0$$

This photon wave function can be written as:

$$\psi_{photon}=\begin{pmatrix}\psi_{e,+}\\ \psi_{i,-}\end{pmatrix}=\begin{pmatrix}\mathbf{E}\\ i\mathbf{B}\end{pmatrix}=\begin{pmatrix}\mathbf{E_0}e^{-i(\omega t-\mathbf{k}\cdot\mathbf{x})}\\ i\mathbf{B_0}e^{-i(\omega t-\mathbf{k}\cdot\mathbf{x})}\end{pmatrix}=\begin{pmatrix}\mathbf{E_0}\\ i\mathbf{B_0}\end{pmatrix}e^{-i(\omega t-\mathbf{k}\cdot\mathbf{x})} \qquad (4.9)$$

After the substitutions $E\rightarrow i\partial_t$ and $\mathbf{p}\rightarrow -i\nabla$, we have from the last expression in (4.8):

$$\begin{pmatrix}i\partial_t & i\mathbf{S}\cdot\nabla\\ i\mathbf{S}\cdot\nabla & i\partial_t\end{pmatrix}\begin{pmatrix}\mathbf{E}\\ i\mathbf{B}\end{pmatrix}=0\rightarrow\begin{pmatrix}\partial_t\mathbf{E}=\nabla\times\mathbf{B}\\ \partial_t\mathbf{B}=-\nabla\times\mathbf{E}\end{pmatrix} \qquad (4.10)$$

where we have used the relationship $\mathbf{S}\cdot(-i\nabla)=\nabla\times$ to derive the latter equations which together with $\nabla\cdot\mathbf{E}=\mathbf{0}$ and $\nabla\cdot\mathbf{B}=\mathbf{0}$ are the Maxwell equations in the source-free vacuum.

Prespacetime model creates a neutrino in Dirac form, if Consciousness does, by replacing the last step of expression (3.87) with the following:

$$\rightarrow\begin{pmatrix}E & -\boldsymbol{\sigma}\cdot\mathbf{p}\\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E\end{pmatrix}\begin{pmatrix}a_{e,+}e^{-ip^{\mu}x_{\mu}}\\ a_{i,-}e^{-ip^{\mu}x_{\mu}}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,+}\\ \psi_{i,-}\end{pmatrix}=L_{M}\psi=0 \qquad (4.11)$$

Prespacetime model creates, sustains and causes evolution of a linear plane-wave antiphoton as follows:

$$1 = e^{i0} = e^{i0}e^{i0} = e^{+iL-iL}e^{+iM-iM}$$

$$(\cos L + i\sin L)(\cos L - i\sin L)e^{+iM-iM} =$$

$$\left(\frac{0}{E} + i\frac{|\mathbf{p}|}{E}\right)\left(\frac{0}{E} - i\frac{|\mathbf{p}|}{E}\right)e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}}$$

$$= \left(+i\frac{|\mathbf{p}|}{E}\right)\left(-i\frac{|\mathbf{p}|}{E}\right)e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}}$$

$$\left(\frac{\mathbf{p}^2}{E^2}\right)e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}} = \left(\frac{E^2}{\mathbf{p}^2}\right)e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}} =$$

$$\left(\frac{E}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E}\right)^{-1}\left(e^{+ip^{\mu}x_{\mu}}\right)\left(e^{+ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow$$

$$\frac{E}{-|\mathbf{p}|}e^{+ip^{\mu}x_{\mu}} = \frac{-|\mathbf{p}|}{E}e^{+ip^{\mu}x_{\mu}} \rightarrow \frac{E}{-|\mathbf{p}|}e^{+ip^{\mu}x_{\mu}} - \frac{-|\mathbf{p}|}{E}e^{+ip^{\mu}x_{\mu}} = 0 \qquad (4.12)$$

$$\rightarrow \begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = L_M \psi = 0$$

$$\rightarrow \begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix} i\mathrm{B}_{0e,-}e^{+ip^{\mu}x_{\mu}} \\ \mathrm{E}_{0i,+}e^{+ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = L_M \psi_{antiphoton} = 0$$

This antiphoton wave function can also be written as:

$$\psi_{antiphoton} = \begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = \begin{pmatrix} i\mathbf{B} \\ \mathbf{E} \end{pmatrix} = \begin{pmatrix} i\mathbf{B}_{\mathbf{0}}e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \\ \mathbf{E}_{\mathbf{0}}e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \end{pmatrix} = \begin{pmatrix} i\mathbf{B}_{\mathbf{0}} \\ \mathbf{E}_{\mathbf{0}} \end{pmatrix}e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \qquad (4.13)$$

Prespacetime model creates an antineutrino in Dirac form by replacing the last step of expression (4.12) with the following:

$$\rightarrow \begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix} a_{e,-}e^{+ip^{\mu}x_{\mu}} \\ a_{i,+}e^{+ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = L_M \psi = 0 \qquad (4.14)$$

Similarly, prespacetime model creates and sustains spaceless (space/distance independent) external and internal wave functions of a mass *m* in Weyl (chiral) form as follows:

$$1 = e^{i0} = e^{i0}e^{i0} = e^{-iL+iL}e^{-iM+iM}$$

$$(\cos L - i\sin L)(\cos L + i\sin L)e^{-iM+iM} =$$

$$\left(\frac{m}{E} - i\frac{0}{E}\right)\left(\frac{m}{E} + i\frac{0}{E}\right)e^{-imt+imt}$$

$$= \left(\frac{m}{E}\right)\left(\frac{m}{E}\right)e^{-imt+imt}$$

$$\left(\frac{m^2}{E^2}\right)e^{-imt+imt} = \left(\frac{E^2}{m^2}\right)e^{-imt+imt} =$$

$$\left(\frac{E}{-m}\right)\left(\frac{-m}{E}\right)^{-1}\left(e^{-imt}\right)\left(e^{-imt}\right)^{-1} \rightarrow$$

$$\frac{E}{-m}e^{-imt} = \frac{-m}{E}e^{-imt} \rightarrow \frac{E}{-m}e^{-imt} - \frac{-m}{E}e^{-imt} = 0 \qquad (4.15)$$

$$\rightarrow \begin{pmatrix} E & -m \\ -m & E \end{pmatrix}\begin{pmatrix} g_{W,e}e^{-imt} \\ g_{W,i}e^{-imt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = L_M V_W = 0$$

Prespacetime model creates, sustains and causes evolution of a spatially self-confined entity such as a proton through imaginary momentum $\mathbf{p}_i$ (downward self-reference such that $m^2 > E^2$) in Dirac form as follows:

$$1 = e^{i0} = e^{i0}e^{i0} = e^{+iL-iL}e^{+iM-iM}$$

$$(\cos L + i\sin L)(\cos L - i\sin L)e^{+iM-iM} =$$

$$\left(\frac{m}{E} + i\frac{|\mathbf{p}_i|}{E}\right)\left(\frac{m}{E} - i\frac{|\mathbf{p}_i|}{E}\right)e^{+ip^\mu x_\mu - ip^\mu x_\mu}$$

$$= \left(\frac{m + i|\mathbf{p}_i|}{E}\right)\left(\frac{m - i|\mathbf{p}_i|}{E}\right)e^{+ip^\mu x_\mu - ip^\mu x_\mu}$$

$$= \left(\frac{m^2 + \mathbf{p}_i^{\,2}}{E^2}\right)e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \frac{E^2 - m^2}{\mathbf{p}_i^{\,2}}e^{+ip^\mu x_\mu - ip^\mu x_\mu}$$

$$= \left(\frac{E-m}{-|\mathbf{p}_i|}\right)\left(\frac{-|\mathbf{p}_i|}{E+m}\right)^{-1}\left(e^{+ip^\mu x_\mu}\right)\left(e^{+ip^\mu x_\mu}\right)^{-1} \rightarrow$$

$$\frac{E-m}{-|\mathbf{p}_i|}e^{+ip^\mu x_\mu}=\frac{-|\mathbf{p}_i|}{E+m}e^{+ip^\mu x_\mu}\rightarrow\frac{E-m}{-|\mathbf{p}_i|}e^{+ip^\mu x_\mu}-\frac{-|\mathbf{p}_i|}{E+m}e^{+ip^\mu x_\mu}=0$$

$$\rightarrow\begin{pmatrix}E-m & -|\mathbf{p}_i|\\ -|\mathbf{p}_i| & E+m\end{pmatrix}\begin{pmatrix}s_{e,-}e^{+iEt}\\ s_{i,+}e^{+iEt}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,-}\\ \psi_{i,+}\end{pmatrix}=L_M\psi=0 \qquad (4.16)$$

After spinization of the last expression in (4.16), we have:

$$\rightarrow\begin{pmatrix}E-m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i\\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & E+m\end{pmatrix}\begin{pmatrix}S_{e,-}e^{+iEt}\\ S_{i,+}e^{+iEt}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,-}\\ \psi_{i,+}\end{pmatrix}=L_M\psi=0 \qquad (4.17)$$

As discussed previously, it is likely that the last expression in (4.16) governs the confinement structure of the unspinized proton in Dirac form through imaginary momentum $\mathbf{p}_i$ and, on the other hand, expression (4.17) governs the confinement structure of spinized proton through $\mathbf{p}_i$.

Thus, an unspinized and spinized antiproton in Dirac form may be respectively governed as follows:

$$\begin{pmatrix}E-m & -|\mathbf{p}_i|\\ -|\mathbf{p}_i| & E+m\end{pmatrix}\begin{pmatrix}s_{e,+}e^{-iEt}\\ s_{i,-}e^{-iEt}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{D,e}\\ \psi_{D,i}\end{pmatrix}=L_M\psi_D=0 \qquad (4.18)$$

$$\begin{pmatrix}E-m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i\\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & E+m\end{pmatrix}\begin{pmatrix}S_{e,+}e^{-iEt}\\ S_{i,-}e^{-iEt}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{D,e}\\ \psi_{D,i}\end{pmatrix}=L_M\psi_D=0 \qquad (4.19)$$

Similarly, prespacetime model creates, sustains and causes evolution of a spatially self-confined entity such as a proton through imaginary momentum $\mathbf{p}_i$ (downward self-reference) in Weyl (chiral) form as follows:

$$1=e^{i0}=e^{i0}e^{i0}=e^{+iL-iL}e^{+iM-iM}$$

$$(\cos L+i\sin L)(\cos L-i\sin L)e^{+iM-iM}=$$

$$\left(\frac{m}{E}+i\frac{|\mathbf{p}_i|}{E}\right)\left(\frac{m}{E}-i\frac{|\mathbf{p}_i|}{E}\right)e^{+ip^\mu x_\mu-ip^\mu x_\mu}$$

$$=\left(\frac{m+i|\mathbf{p}_i|}{E}\right)\left(\frac{m-i|\mathbf{p}_i|}{E}\right)e^{+ip^\mu x_\mu-ip^\mu x_\mu}$$

$$=\left(\frac{m^2+\mathbf{p}_i{}^2}{E^2}\right)e^{+ip^\mu x_\mu - ip^\mu x_\mu}=\frac{E^2-\mathbf{p}_i^2}{m^2}e^{+ip^\mu x_\mu - ip^\mu x_\mu}=$$

$$\left(\frac{E-|\mathbf{p}_i|}{-m}\right)\left(\frac{-m}{E+|\mathbf{p}_i|}\right)^{-1}\left(e^{+ip^\mu x_\mu}\right)\left(e^{+ip^\mu x_\mu}\right)^{-1}\rightarrow$$

$$\frac{E-|\mathbf{p}_i|}{-m}e^{+ip^\mu x_\mu}=\frac{-m}{E+|\mathbf{p}_i|}e^{+ip^\mu x_\mu}\rightarrow\frac{E-|\mathbf{p}_i|}{-m}e^{+ip^\mu x_\mu}-\frac{-m}{E+|\mathbf{p}_i|}e^{+ip^\mu x_\mu}=0$$

$$\rightarrow\begin{pmatrix}E-|\mathbf{p}_i| & -m\\ -m & E+|\mathbf{p}_i|\end{pmatrix}\begin{pmatrix}s_{e,r}e^{+iEt}\\ s_{i,l}e^{+iEt}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,r}\\ \psi_{i,l}\end{pmatrix}=L_M\psi=0 \quad (4.20)$$

After spinization of expression (3.114), we have:

$$\rightarrow\begin{pmatrix}E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m\\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i\end{pmatrix}\begin{pmatrix}S_{e,r}e^{+iEt}\\ S_{i,l}e^{+iEt}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,r}\\ \psi_{i,l}\end{pmatrix}=L_M\psi=0 \quad (4.21)$$

It is likely that the last expression in (4.20) governs the structure of the unspinized proton in Weyl form and expression (4.21) governs the structure of spinized proton in Weyl form.

Thus, an unspinized and spinized antiproton in Weyl form may be respectively governed as follows:

$$\begin{pmatrix}E-|\mathbf{p}_i| & -m\\ -m & E+|\mathbf{p}_i|\end{pmatrix}\begin{pmatrix}s_{e,l}e^{-iEt}\\ s_{i,r}e^{-iEt}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,l}\\ \psi_{i,r}\end{pmatrix}=L_M\psi=0 \quad (4.22)$$

$$\begin{pmatrix}E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m\\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i\end{pmatrix}\begin{pmatrix}S_{e,l}e^{-iEt}\\ S_{i,r}e^{-iEt}\end{pmatrix}=\begin{pmatrix}L_{M,e} & L_{M,i}\end{pmatrix}\begin{pmatrix}\psi_{e,l}\\ \psi_{i,r}\end{pmatrix}=L_M\psi=0 \quad (4.23)$$

4.2 Scientific Genesis of Composite Entities

Prespacetime model create, sustain and cause evolution of a neutron in Dirac form which is comprised of an unspinized proton:

$$\left(\begin{pmatrix}E-e\phi-m & -|\mathbf{p}_i-e\mathbf{A}|\\ -|\mathbf{p}_i-e\mathbf{A}| & E-e\phi+m\end{pmatrix}\begin{pmatrix}s_{e,-}e^{+iEt}\\ s_{i,+}e^{+iEt}\end{pmatrix}=0\right)_p \quad (4.24)$$

and a spinized electron:

$$\left(\begin{pmatrix} E+e\phi-V-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi-V+m \end{pmatrix}\begin{pmatrix} S_{e,+}e^{-iEt} \\ S_{i,-}e^{-iEt} \end{pmatrix}=0\right)_e \quad (4.25)$$

as follows:

$$1=e^{i0}=e^{i0}e^{i0}e^{i0}e^{i0}=\left(e^{i0}e^{i0}\right)_p\left(e^{i0}e^{i0}\right)_e=\left(e^{+iL-iM}e^{+iM-iM}\right)_p\left(e^{-iL+iL}e^{-iM+iM}\right)_e$$

$$=\left((\cos L+i\sin L)(\cos L-i\sin L)e^{+iM-iM}\right)_p\left((\cos L-i\sin L)(\cos L+i\sin L)e^{-iM+iM}\right)_e$$

$$=\left(\left(\frac{m}{E}+i\frac{|\mathbf{p}_i|}{E}\right)\left(\frac{m}{E}-i\frac{|\mathbf{p}_i|}{E}\right)e^{+ip^\mu x_\mu-ip^\mu x_\mu}\right)_p\left(\left(\frac{m}{E}-i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E}+i\frac{|\mathbf{p}|}{E}\right)e^{-ip^\mu x_\mu+ip^\mu x_\mu}\right)_e$$

$$=\left(\frac{m^2+\mathbf{p}_i^{\,2}}{E^2}e^{+ip^\mu x_\mu-ip^\mu x_\mu}\right)_p\left(\frac{m^2+\mathbf{p}^2}{E^2}e^{-ip^\mu x_\mu+ip^\mu x_\mu}\right)_e$$

$$=\left(\frac{E^2-m^2}{\mathbf{p}_i^2}e^{+ip^\mu x_\mu-ip^\mu x_\mu}\right)_p\left(\frac{E^2-m^2}{\mathbf{p}^2}e^{-ip^\mu x_\mu+ip^\mu x_\mu}\right)_e=$$

$$\left(\left(\frac{E-m}{-|\mathbf{p}_i|}\right)\left(\frac{-|\mathbf{p}_i|}{E+m}\right)^{-1}\left(e^{+ip^\mu x_\mu}\right)\left(e^{+ip^\mu x_\mu}\right)^{-1}\right)_p\left(\left(\frac{E-m}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E+m}\right)^{-1}\left(e^{-ip^\mu x_\mu}\right)\left(e^{-ip^\mu x_\mu}\right)^{-1}\right)_e$$

$$\rightarrow\left(\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix}\begin{pmatrix} s_{e,-}e^{+iEt} \\ s_{i,+}e^{+iEt} \end{pmatrix}=0\right)_p\left(\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} s_{e,+}e^{-iEt} \\ s_{i,-}e^{-iEt} \end{pmatrix}=0\right)_e$$

$$\rightarrow\begin{pmatrix} \left(\begin{pmatrix} E-e\phi-m & -|\mathbf{p}_i-e\mathbf{A}| \\ -|\mathbf{p}_i-e\mathbf{A}| & E-e\phi+m \end{pmatrix}\begin{pmatrix} s_{e,-}e^{+iEt} \\ s_{i,+}e^{+iEt} \end{pmatrix}=0\right)_p \\ \\ \left(\begin{pmatrix} E+e\phi-V-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi-V+m \end{pmatrix}\begin{pmatrix} S_{e,+}e^{-iEt} \\ S_{i,-}e^{-iEt} \end{pmatrix}=0\right)_e \end{pmatrix}_n \quad (4.26)$$

In expressions (4.24), (4.25) and (4.26), $(\ )_p$, $(\ )_e$ and $(\ )_n$ indicate proton, electron and neutron respectively. Further, unspinized proton has charge e, electron has charge –e, $\left(A^\mu=(\phi,\mathbf{A})\right)_p$ and $\left(A^\mu=(\phi,\mathbf{A})\right)_e$ are the electromagnetic potentials acting on unspinized proton and tightly bound spinized electron respectively, and $(V)_e$ is a binding potential from the unspinized proton acting on the spinized electron causing tight binding as discussed later.

If $\left(A^{\mu}=(\phi,\mathbf{A})\right)_p$ is negligible due to the fast motion of the tightly bound spinized electron, we have from the last expression in (4.26):

$$\rightarrow\begin{pmatrix}\left(\begin{pmatrix}E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m\end{pmatrix}\begin{pmatrix}s_{e,-}e^{+iEt} \\ s_{i,+}e^{+iEt}\end{pmatrix}=0\right)_p \\ \\ \left(\begin{pmatrix}E+e\phi-V-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi-V+m\end{pmatrix}\begin{pmatrix}S_{e,+}e^{-iEt} \\ S_{i,-}e^{-iEt}\end{pmatrix}=0\right)_e\end{pmatrix}_n \quad (4.27)$$

Experimental data on charge distribution and *g*-factor of neutron seem to support a neutron comprising of an unspinized proton and a tightly bound spinized electron.

The Weyl (chiral) form of the last expression in (4.26) and expression (4.27) are respectively as follows:

$$\begin{pmatrix}\left(\begin{pmatrix}-e\phi-|\mathbf{p}_i-e\mathbf{A}| & -m \\ -m & -e\phi+|\mathbf{p}_i-e\mathbf{A}|\end{pmatrix}\begin{pmatrix}s_{e,r}e^{+iEt} \\ s_{i,l}e^{+iEt}\end{pmatrix}=0\right)_p \\ \\ \left(\begin{pmatrix}E+e\phi-V-\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & -m \\ -m & E+e\phi-V+\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\end{pmatrix}\begin{pmatrix}S_{e,l}e^{-iEt} \\ S_{i,r}e^{-iEt}\end{pmatrix}=0\right)_e\end{pmatrix}_n \quad (4.28)$$

$$\begin{pmatrix}\left(\begin{pmatrix}E-|\mathbf{p}_i| & -m \\ -m & E+|\mathbf{p}_i|\end{pmatrix}\begin{pmatrix}s_{e,r}e^{+iEt} \\ s_{i,l}e^{+iEt}\end{pmatrix}=0\right)_p \\ \left(\begin{pmatrix}E+e\phi-V-\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & -m \\ -m & E+e\phi-V+\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\end{pmatrix}\begin{pmatrix}S_{e,l}e^{-iEt} \\ S_{i,r}e^{-iEt}\end{pmatrix}=0\right)_e\end{pmatrix}_n \quad (4.29)$$

Prespacetime model create, sustain and cause evolution of a hydrogen atom comprising of a spinized proton:

$$\left(\begin{pmatrix}E-e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}_i-e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}_i-e\mathbf{A}) & E-e\phi+m\end{pmatrix}\begin{pmatrix}S_{e,-}e^{+iEt} \\ S_{i,+}e^{+iEt}\end{pmatrix}=0\right)_p \quad (4.30)$$

and a spinized electron:

$$\left(\begin{pmatrix}E+e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi+m\end{pmatrix}\begin{pmatrix}S_{e,+}e^{-iEt} \\ S_{i,-}e^{-iEt}\end{pmatrix}=0\right)_e \quad (4.31)$$

in Dirac form as follows:

$$1 = e^{i0} = e^{i0}e^{i0}e^{i0}e^{i0} = \left(e^{i0}e^{i0}\right)_p\left(e^{i0}e^{i0}\right)_e = \left(e^{+iL-iM}e^{+iM-iM}\right)_p\left(e^{-iL+iL}e^{-iM+iM}\right)_e$$

$$= \left((\cos L + i\sin L)(\cos L - i\sin L)e^{+iM-iM}\right)_p\left((\cos L - i\sin L)(\cos L + i\sin L)e^{-iM+iM}\right)_e$$

$$= \left(\left(\frac{m}{E} + i\frac{|\mathbf{p}_i|}{E}\right)\left(\frac{m}{E} - i\frac{|\mathbf{p}_i|}{E}\right)e^{+ip^\mu x_\mu - ip^\mu x_\mu}\right)_p\left(\left(\frac{m}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E} + i\frac{|\mathbf{p}|}{E}\right)e^{-ip^\mu x_\mu + ip^\mu x_\mu}\right)_e$$

$$= \left(\frac{m^2 + \mathbf{p}_i^{\,2}}{E^2}e^{+ip^\mu x_\mu - ip^\mu x_\mu}\right)_p\left(\frac{m^2 + \mathbf{p}^2}{E^2}e^{-ip^\mu x_\mu + ip^\mu x_\mu}\right)_e$$

$$= \left(\frac{E^2 - m^2}{\mathbf{p}_i^2}e^{+ip^\mu x_\mu - ip^\mu x_\mu}\right)_p\left(\frac{E^2 - m^2}{\mathbf{p}^2}e^{-ip^\mu x_\mu + ip^\mu x_\mu}\right)_e =$$

$$\left(\left(\frac{E-m}{-|\mathbf{p}_i|}\right)\left(\frac{-|\mathbf{p}_i|}{E+m}\right)^{-1}\left(e^{+ip^\mu x_\mu}\right)\left(e^{+ip^\mu x_\mu}\right)^{-1}\right)_p\left(\left(\frac{E-m}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E+m}\right)^{-1}\left(e^{-ip^\mu x_\mu}\right)\left(e^{-ip^\mu x_\mu}\right)^{-1}\right)_e$$

$$\rightarrow \left(\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix}\begin{pmatrix} s_{e,-}e^{+iEt} \\ s_{i,+}e^{+iEt} \end{pmatrix} = 0\right)_p\left(\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} s_{e,+}e^{-iEt} \\ s_{i,-}e^{-iEt} \end{pmatrix} = 0\right)_e$$

$$\rightarrow \left(\begin{array}{l} \left(\begin{pmatrix} E-e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}_i - e\mathrm{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}_i - e\mathrm{A}) & E-e\phi+m \end{pmatrix}\begin{pmatrix} S_{e,-}e^{+iEt} \\ S_{i,+}e^{+iEt} \end{pmatrix} = 0\right)_p \\ \left(\begin{pmatrix} E+e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi+m \end{pmatrix}\begin{pmatrix} S_{e,+}e^{-iEt} \\ S_{i,-}e^{-iEt} \end{pmatrix} = 0\right)_e \end{array}\right)_h \qquad (4.32)$$

In expressions (4.30), (4.31) and (4.32), $(\;)_p$, $(\;)_e$ and $(\;)_h$ indicate proton, electron and hydrogen atom respectively. Again, proton has charge e, electron has charge –e, and $\left(A^\mu = (\phi, \mathbf{A})\right)_p$ and $\left(A^\mu = (\phi, \mathbf{A})\right)_e$ are the electromagnetic potentials acting on spinized proton and spinized electron respectively.

Again, if $\left(A^\mu = (\phi, \mathbf{A})\right)_p$ is negligible due to fast motion of the orbiting spinized electron, we have from the last expression in (3.129):

$$\rightarrow\begin{pmatrix}\left(\begin{pmatrix}E-m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i\\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & E+m\end{pmatrix}\begin{pmatrix}S_{e,-}e^{+iEt}\\ S_{i,+}e^{+iEt}\end{pmatrix}=0\right)_p\\ \left(\begin{pmatrix}E+e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi+m\end{pmatrix}\begin{pmatrix}S_{e,+}e^{-iEt}\\ S_{i,-}e^{-iEt}\end{pmatrix}=0\right)_e\end{pmatrix}_h \quad (4.33)$$

The Weyl (chiral) form of the last expression in (3.129) and expression (3.130) are respectively as follows:

$$\begin{pmatrix}\left(\begin{pmatrix}E-e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}_i-e\mathbf{A}) & -m\\ -m & E-e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}_i-e\mathbf{A})\end{pmatrix}\begin{pmatrix}S_{e,r}e^{+iEt}\\ S_{i,l}e^{+iEt}\end{pmatrix}=0\right)_p\\ \left(\begin{pmatrix}E+e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & -m\\ -m & E+e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\end{pmatrix}\begin{pmatrix}S_{e,l}e^{-iEt}\\ S_{i,r}e^{-iEt}\end{pmatrix}=0\right)_e\end{pmatrix}_h \quad (4.34)$$

$$\begin{pmatrix}\left(\begin{pmatrix}E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m\\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i\end{pmatrix}\begin{pmatrix}S_{e,r}e^{+iEt}\\ S_{i,l}e^{+iEt}\end{pmatrix}=0\right)_p\\ \left(\begin{pmatrix}E+e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & -m\\ -m & E+e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\end{pmatrix}\begin{pmatrix}S_{e,l}e^{-iEt}\\ S_{i,r}e^{-iEt}\end{pmatrix}=0\right)_e\end{pmatrix}_h \quad (4.35)$$

5. MATHEMATICS & ONTOLOGY OF ETHER

Ether is Mathematical,
Immanent & Transcendental

5.1 Mathematical Aspect of Ether

In the prespacetime model, it is our comprehension that:

(1) The mathematical representation of the primordial ether in prespacetime is the Euler's number (Euler's Constant) *e* which makes the Euler's identity possible:

$$e^{i\pi}+1=0 \quad (5.1)$$

(2) Euler's number *e* is the foundation of primordial distinction in prespacetime:

$$1=\mathbf{e}^{i0}=\mathbf{e}^{i0}\mathbf{e}^{i0}=\mathbf{e}^{iL-iL}\mathbf{e}^{iM-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{-iL}\mathbf{e}^{-iM}/\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}/\mathbf{e}^{iL}\mathbf{e}^{iM}\ldots \quad (5.2)$$

(3) Euler's number *e* is the foundation of the genesis of energy, momentum & mass relationship in prespacetime:

$$1 = e^{i0} = e^{-iL+iL} = L_e L_i^{-1} = (\cos L - i\sin L)(\cos L + i\sin L) = \tag{5.3}$$

$$\left(\frac{m}{E} - i\frac{|\mathbf{p}|}{E}\right)\left(\frac{m}{E} + i\frac{|\mathbf{p}|}{E}\right) = \left(\frac{m - i|\mathbf{p}|}{E}\right)\left(\frac{m + i|\mathbf{p}|}{E}\right) = \left(\frac{m^2 + \mathbf{p}^2}{E^2}\right) \rightarrow$$

$$E^2 = m^2 + \mathbf{p}^2$$

(4) Euler's number *e* is the foundation of the genesis, sustenance and evolution of an elementary particle in prespacetime:

$$1 = e^{i0} = e^{i0}e^{i0} = e^{-iL+iL}e^{-iM+iM} = L_e L_i^{-1}\left(e^{-iM}\right)\left(e^{-iM}\right)^{-1} \rightarrow \tag{5.4}$$

$$\begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} A_e e^{-iM} \\ A_i e^{-iM} \end{pmatrix} = L_M \begin{pmatrix} A_e \\ A_i \end{pmatrix} e^{-iM} = L_M \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = L_M \psi = 0$$

(5) Euler's number *e* is also the foundation of quantum entanglement or gravity in prespacetime.

(6) Euler's number is immanent in the sense that it is the ingredient of (1) to (5) thus all "knowing" and all "present."

(7) Euler's number is also transcendental in the sense that is the foundation of existence thus "omnipotent" and beyond creation.

5.2 Immanent Aspect of Ether

In the prespacetime model, the immanent aspect of ether associated with individual entity ("i-ether") has following attributes:

i-ether is the ingredient of atoms, of molecules, of cells, of a body;
i-ether is in space, time, motion, rest;
i-ether is governed by the laws of physics, chemistry, biology;
i-ether is the ingredient of this world, the Earth, the Solar System.

i-ether is the ingredient of awareness, feeling, imagination, free will;
i-ether is in love, passion, hope, despair;
i-ether is governed by the laws of psychology, economics, sociology;
i-ether is the ingredient of mind, soul, spirit.

In the prespacetime model, the immanent of ether associated with the universal entity ("I-ETHER") has following attributes:

I-ETHER IS atoms, molecules, cells, body;
I-ETHER IS space, time, motion, rest;
I-ETHER IS laws of physics, chemistry, biology, physiology;
I-ETHER IS this World, the Earth, the Solar System;

I-ETHER IS awareness, feeling, imagination, free will;
I-ETHER IS love, passion, hope, despair;
I-ETHER IS the laws of psychology, economics, sociology;
I-ETHER IS mind, soul, spirit.

5.3 Transcendental Aspect of Ether

In the prespacetime model, the transcendental aspect of ether associated with individual/entity ("t-ether") has following attributes:

t-ether is not the ingredient of atoms, of molecules, of cells, of a body;
t-ether is not in space, time, motion, rest;
t-ether is not governed by the laws of physics, chemistry, biology;
t-ether is not the ingredient of this world, the Earth, the Solar System.

t-ether is beyond awareness, feeling, imagination, free will;
t-ether is beyond love, passion, hope, despair;
t-ether is beyond the laws of psychology, economics, sociology;
t-ether is beyond mind, soul, spirit.

In the prespacetime model, the transcendental aspect of ether associated with the universal entity ("T-ETHER") has following attributes:

T-ETHER IS NOT the atoms, molecules, cells, body;
T-ETHER IS NOT the space, time, motion, rest;
T-ETHER IS NOT the laws of physics, chemistry, biology;
T-ETHER IS NOT this world, the Earth, the Solar System;

T-ETHER IS NOT awareness, feeling, imagination, free will;
T-ETHER IS NOT love, passion, hope, despair;
T-ETHER IS NOT the laws of psychology, economics, sociology;
T-ETHER IS NOT mind, soul, spirit.

6. CONCLUSION

This work is the continuation of the prespacetime model described previously (Hu & Wu, 2010). It has mainly dealt with the genesis of self-referential Matrix Law and the ontology

& mathematics of ether which have been discovered by us in continuation. Yet again, we caution our colleagues and readers that we as humans can only strive for perfection, completeness and correctness in our comprehensions and writings because we ourselves are limited and imperfect.

According to the prespacetime model, in the beginning there was prespacetime by itself $\mathbf{e}^0=1$ materially empty and it began to imagine through primordial self-referential spin $1=\mathbf{e}^{i0}=\mathbf{e}^{i0}\mathbf{e}^{i0}=\mathbf{e}^{iL-iL}\mathbf{e}^{iM-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{-iL}\mathbf{e}^{-iM}/\mathbf{e}^{-iL}\mathbf{e}^{-iM}=\mathbf{e}^{iL}\mathbf{e}^{iM}/\mathbf{e}^{iL}\mathbf{e}^{iM}$…such that it created the self-referential Matrix Law, the external object to be observed and internal object as observed, separated them into external world and internal world, caused them to interact through said Matrix Law and thus gave birth to the Universe which it has since sustained and made to evolve. The Natural laws created in accordance with the prespacetime model are hierarchical and comprised of: (1) immanent Law of Conservation manifesting and governing in the external or internal world which may be violated in certain processes; (2) immanent Law of Zero manifesting and governing in the dual world as a whole; and (3) transcendental Law of One manifesting and governing in prespacetime.

Let it be known that prespacetime model is supported by experiments (or has sound basis in empirical evidence), since experimentally, we demonstrated that there exists an instantaneous transcendental force (quantum entanglement or gravity) beyond spacetime which makes omnipotence, omnipresence and omniscience of prespacetime possible and feasible (see Hu & Wu, 2001-2010).

In the prespacetime model, the principles and mathematics used to create, sustain and makes evolving of elementary particles are beautiful and simple. First, prespacetime model employs the following ontological principles among others: (1) Principle of oneness/unity of existence through quantum entanglement in the body (ether) of prespacetime; and (2) Principle of hierarchical primordial self-referential spin creating:

- Energy-Momentum-Mass Relationship as Transcendental Law of One
- Energy-Momentum-Mass Relationship as Determinant of Matrix Law
- Dual-world Law of Zero of Energy, Momentum & Mass
- Immanent Law of Conservation of Energy, Momentum & Mass in External/Internal World which may be violated in certain processes

Second, prespacetime employs the following mathematical elements & forms among others in order to empower the above ontological principles among others:

(1) *e*, Euler's number, for (to empower) ether (aether) as foundation/basis/medium of existence (body of prespacetime);
(2) *i*, imaginary number, for (to empower) thoughts and imagination;
(3) 0, zero, for (to empower) emptiness/undifferentiated/primordial state;
(4) 1, one, for (to empower) oneness/unity of existence;
(5) +, -, *, /, = for (to empower) creation, dynamics, balance & conservation;
(6) Pythagorean theorem for (to empower) Energy-Momentum-Mass Relationship; and

(7) *M*, matrix, for (to empower) the external and internal worlds (the Dual World) and the interaction of external and internal worlds.

DEDICATION:

We dedicate this work to prespacetime which in the prespacetime model created the self-referential Matrix Law, the external object to be observed and internal object as observed, separated them into external world and internal world, caused them to interact through said Matrix Law and thus gave birth to the Universe.

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