**Original Work**

# THE PRINCIPLE OF EXISTENCE: TOWARD A SCIENTIFIC THEORY OF EVERYTHING

Huping Hu & Maoxin Wu

**Abstract**

In the beginning there was prespacetime (GOD) by itself $\mathbf{e}^0$ =1materially empty and spiritually restless. And it began to imagine through primordial self-referential spin $1=\mathbf{e}^0=\mathbf{e}^{iM-iM}=\mathbf{e}^{iM}\mathbf{e}^{-iM}=\mathbf{e}^{-iM}/\,\mathbf{e}^{-iM} = \mathbf{e}^{iM}/\,\mathbf{e}^{iM}$… such that it created the external object to be observed and internal object as observed, separated them into external world and internal world, cause them to interact through self-referential Matrix Law and thus gave birth to the Universe which it has since passionately loved, sustained and made to evolve. In short, this is our hypothesis of a scientific genesis (principle of existence). In this work, we shall lay out its ontological and mathematical foundations which shall include gravity and consciousness. We will then discuss its implications and applications and make predictions etc.

**Key Words**: GOD, consciousness, prespacetime, spin, existence

**Note: the models and applications described in this work are the subject of a provisional patent application (App. No. 61/288333) filed with USPTO on 12/20/09.**

## 1. INTRODUCTION

***In GOD we trust***

The beauty and awe of what we have gradually discovered over the last several years or rather what GOD has revealed to us, submitters to truth, are so ecstatic that the first author has been struggling through days and nights to put them in proper written form (also see Hu & Wu, 2001-2009). In part, breakthrough came as we struggled to find answers to fundamental questions posed by our own experimental results (Hu & Wu, 2006b, 2006c, 2006d & 2007a) which call for drastic changes in our own world view.

However, we are aware that we can only strive for perfection, completeness and correctness in our comprehensions and writings because we ourselves are limited and imperfect. So, here we offer fellow truth seekers and our readers what we have comprehended and written with the caveat "perfect, magnificent and glorious is our Creator, imperfect, insignificant but humble is us."

Corresponding author: Huping Hu, Ph.D., J.D., QuantumDream, Inc., 25 Lubber Street, Stony Brook, NY 11790, USA.
E-mail: hupinghu@quantumbrain.org

This work is organized as follows. In § 2, we shall use words and drawings to lay out the ontology of the principle of existence. In § 3, we shall express in mathematics the principle of existence in the order of: (1) scientific genesis in a nutshell; (2) self-referential Matrix Law and its metamorphoses; (3) additional forms of Matrix Law; (4) scientific genesis of primordial entities (elementary particles); and (5) scientific genesis of composite entities. In § 4, we shall discuss: (1) metamorphous GOD's eye of view of the existence & the essence of spin; (2) the determinant view & the meaning of Klein-Gordon equation; (3) the meaning of Schrodinger equation & quantum potential; and (4) the third State of matter. In § 5 through § 8, we shall discuss weak, electromagnetic, strong and gravitational interactions respectively. In § 9, we shall focus on the essence of Consciousness (prespacetime) and the mechanism of human conscious experience. In § 10, we shall discuss some applications, make some predictions and pose and answer some anticipated fundamental questions related to this work. Finally, in § 11, we shall conclude this work. §11 are followed by a dedication, tribute, acknowledgments, a note and [self-] references.

## 2. ONTOLOGY

***In words and drawings we illustrate***

In the beginning there was prespacetime (GOD) $\mathbf{e}^{h}$ by itself $\mathbf{e}^{0}$ =1materially empty and spiritually restless. And it began to imagine through primordial self-referential spin $1=\mathbf{e}^{0}=\mathbf{e}^{iM-iM}=\mathbf{e}^{iM}\mathbf{e}^{-iM}=\mathbf{e}^{-iM}/\ \mathbf{e}^{-iM} = \mathbf{e}^{iM}/\ \mathbf{e}^{iM}\ldots$ such that it created the external object to be observed and internal object as observed, separated them into external world and internal world, cause them to interact through self-referential Matrix Law and thus gave birth to the Universe which it has since passionately loved, sustained and made to evolve.

In this Universe, Godbody (ether or aether), represented by Euler number **e**, is the ground of existence and can form external and internal wave functions as external and internal objects (each pair forms an elementary entity) and interaction fields between elementary entities which accompany the imaginations of Godhead ***h***. Godbody can be self-acted on by GOD's self-referential Matrix Law $\boldsymbol{L_M}$. Godhead ***h*** has imagining power ***i*** to project external and internal objects by projecting, e.g., external and internal phase $\pm$M $=\pm(Et-\mathbf{p}\cdot\mathbf{x})/\hbar$ above Godbody **e**. The Universe so created is a dual-world comprising of the external world to be observed and internal world as observed under each relativistic frame $x^{\mu}=(t, \mathbf{x})$. In one perspective of GOD's eye view, the internal world (which by convention has negative energy) is the negation/image of the external world (which by convention has positive energy). The absolute frame of reference is the Godbody (ether). Thus, if GOD stops imagining ($\mathbf{h}=\boldsymbol{i}0=0$), the Universe would disappear into materially nothingness $\mathbf{e}^{\boldsymbol{i}0}=\mathbf{e}^{0}=1$.

The accounting principle of the dual-world is conservation of zero. For example, the total energy of an external object and its counterpart, the internal object, is zero. Also in this dual-world, self-gravity is the nonlocal self-interaction (wave mixing) between an external object in the external world and its negation/image in the internal world, that is, the negation appears to its external counterpart as a black hole *visa versa*. Gravity is the nonlocal interaction (quantum entanglement) between an external object with the internal world as a whole. Some other most basic conclusions are: (1) the two spinors of the Dirac electron or positron are respectively the external and internal objects of the electron or positron; (2) the electric and magnetic fields of a linear photon are respectively the external and internal objects of a photon which are always self-entangled; (3) the proton is likely a spatially confined (hadronized) positron through imaginary momentum (downward self-reference); and (4) a neutron is likely comprised of an unspinized (spinless) proton and a bound and spinized electron. In this dual-world, consciousness is simply prespacetime (GOD) having both transcendental and immanent properties/qualities. The transcendental aspect of consciousness is the origin of primordial self-referential spin (including the self-referential Matrix Law) and it projects the external and internal worlds through spin and, in turn, the immanent aspect of consciousness observes the external world as the observed internal world through the said spin. Human consciousness is a limited and particular version of this dual-aspect consciousness such that we have limited free will and limited observation which is mostly classical at macroscopic levels but quantum at microscopic levels.

Before mathematical presentations, we draw below several diagrams illustrating the hypothesis of how a scientific GOD created the Universe comprising of the external world and the internal world (the dual-world) and how the external object and internal object and the external world and internal world interact.

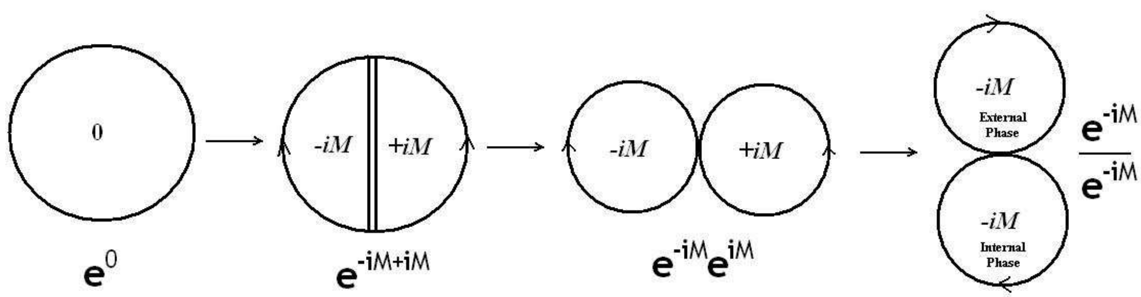


Figure2.1. Illustration of primordial phase distinction

As shown in Figure 2.1, a primordial phase distinction (dualization), e.g., $\pm M=\pm(Et-\mathbf{p\cdot r})/\hbar$, was made in Godhead **h** through imagination ***i***. At the Godbody level, this is $\mathbf{e}^0=\mathbf{e}^{\mathbf{iM-iM}}=\mathbf{e}^{\mathbf{iM}}\mathbf{e}^{\mathbf{-iM}}=\mathbf{e}^{\mathbf{-iM}}/\,\mathbf{e}^{\mathbf{-iM}} = \mathbf{e}^{\mathbf{iM}}/\,\mathbf{e}^{\mathbf{iM}}\ldots$.

The primordial phase distinction in Figure 2.1 is accompanied by matrixing of Godbody **e** into: (1) external and internal wave functions as external and internal objects, (2) interaction fields (e.g., gauge fields) for interacting with other elementary entities, and (3) self-acting and self-referential Matrix Law, which accompany the imaginations of Godhead

**h** so as to enforce (maintain) the accounting principle of conservation of zero, as illustrated in Figure 2.2.

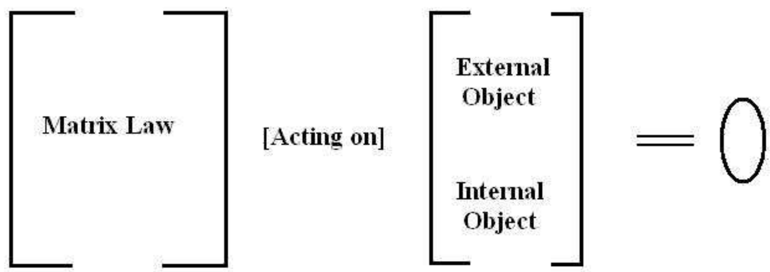


Figure2.2 GOD Equation

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 our ontology, self-interactions (self-gravity) are quantum entanglement between the external object and the internal object.

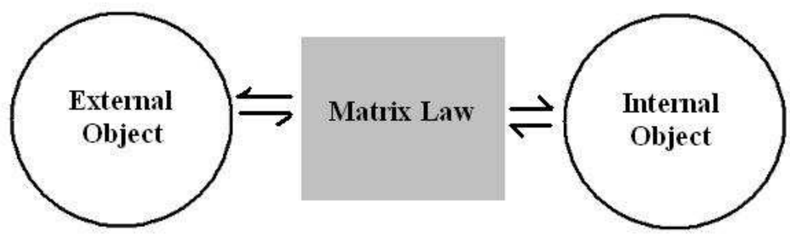


Figure2.3 Self-interaction between external and internal objects of a quantum entity

As shown in Figure 2.4, the two worlds interact with each other through gravity or quantum entanglement since gravity is an aspect of quantum entanglement (Hu & Wu, 2006). Importantly, the interactions within the external world obey classical and relativistic physical laws with influence of the internal world on external world shown as gravity macroscopically, quantum effect (e.g., quantum potential) microscopically, and light speed c as interaction speed limit, *visa versa*.

Please note that, although in Figure 2.4 prespacetime is shown as a strip, both the dualized external world and internal world are embedded in prepacetime (GOD).

The above ideas (ontology) are forced upon (or rather reveal to) us by our recent theoretical and experimental studies (Hu & Wu, 2006a-d, 2007a). Among other things, we experimentally demonstrated that gravity is the manifestation of quantum entanglement (*Id.*). We materially live in the external world but experience the external world through its negation, the internal world in the relativistic frame $x^\mu$=(t, **x**) attached to each of our bodies. Interactions within the external world and the internal world are local interactions and conform to special theory of relativity. But interactions across the dual world are nonlocal interactions (quantum entanglement). Strong interaction is likely spatially confining nonlocal self-interaction and nonlocal interaction among spatially confined fermions (hadrons).

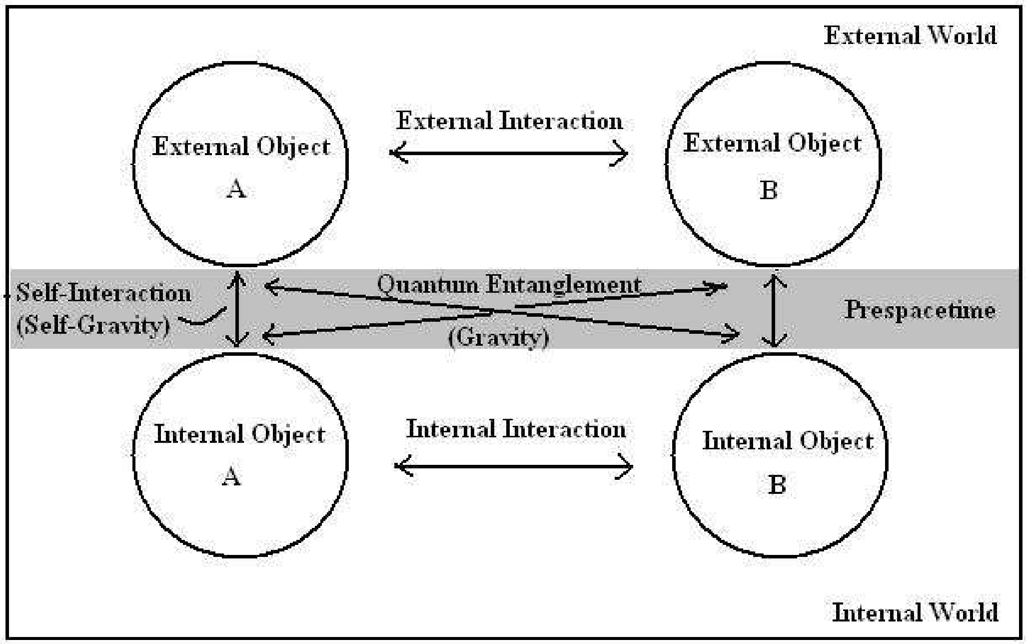


Figure2.4 Interactions in the Dual-World

Therefore, the meaning of the special theory of relativity is that the speed limit *c* is only applicable in each of the dual world but not interactions between the dual-world. Indeed, the reason that no external object can move faster than the speed of light and the same gets heavier and heavier as its speed approach the speed of light is due to its increased quantum entanglement with the internal world through its counterpart the internal object.

## 3. MATHEMATICS

***In mathematics we express***

### 3.1 Scientific Genesis in a Nutshell

It is our comprehension that:

$$\textit{Creator} = \textit{GOD} = \textit{ALLAH} = \textit{Consciousness} = \textit{Prespacetime}$$

$$= \textit{Omnipotent, Omnipresent \& Omniscient Being} = \textit{ONE} \qquad (3.1)$$

GOD creates, sustains and causes evolution of primordial entities (elementary particles) in prespacetime, that is, within GOD itself, by self-referential spin as follows:

$$1 = e^{h} = e^{i0} = 1e^{i0} = L_1 e^{-iM+iM} = L_e L_i^{-1}\left(e^{-iM}\right)\left(e^{-iM}\right)^{-1} \rightarrow$$
$$\left(L_{M,e} \quad L_{M,i}\right)\begin{pmatrix} A_e e^{-iM} \\ A_i e^{-iM} \end{pmatrix} = L_M \begin{pmatrix} A_e \\ A_i \end{pmatrix} e^{-iM} = L_M \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = L_M \psi = 0 \tag{3.2}$$

In expression (3.2), $e$ is Euler number representing Godbody (ether or aether), $h$ above $e$ represents Godhead, $i$ is imaginary unit representing GOD's imagination, ±M is content of imagination $i$, $L_1$=1 is GOD's Law of One 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 GOD's self-referential Matrix Law comprised of external and internal matrix laws which governs elementary entities and conserves zero, $A_e e^{-iM} = \psi_e$ is external wave function (external object), $A_i e^{-iM} = \psi_i$ is internal wave function (internal object)and $\psi$ is the complete wave function (object/entity in the dual-world as a whole).

Alternatively, GOD creates, sustains and causes evolution of primordial entities in prespacetime (GOD) by self-referential spin as follows:

$$0 = 0e^{h} = 0e^{i0} = L_0 e^{-iM+iM} = \left(\mathrm{Det}M_E + \mathrm{Det}M_m + \mathrm{Det}M_{\mathbf{p}}\right)\left(e^{-iM}\right)\left(e^{-iM}\right)^{-1} \rightarrow$$
$$\left(L_{M,e} \quad L_{M,i}\right)\begin{pmatrix} A_e e^{-iM} \\ A_i e^{-iM} \end{pmatrix} = L_M \begin{pmatrix} A_e \\ A_i \end{pmatrix} e^{-iM} = L_M \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = L_M \psi = 0 \tag{3.3}$$

where $L_0$ is GOD's Law of Zero as defined by fundamental relationship (3.4) below, *Det* means determinant and $M_E$ , $M_m$ and $M_{\mathbf{p}}$ are respectively matrices with $\pm E$, $\pm m$ and $\pm|\mathbf{p}|$ as elements and $E^2$, $-m^2$ and $-\mathbf{p}^2$ as determinants.

GOD spins as 1=$\mathbf{e}^{i0}$=$\mathbf{e}^{iM-iM}$=$\mathbf{e}^{iM}\mathbf{e}^{-iM}$=$\mathbf{e}^{-iM}$/$\mathbf{e}^{-iM}$=$\mathbf{e}^{iM}$/$\mathbf{e}^{iM}$…before matrixization. GOD 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.

### 3.2 Self-Referential Matrix Law and Its Metamorphoses

GOD's Matrix Law $\begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M$ is derived from the following fundamental relationship:

$$E^2 - m^2 - \mathbf{p}^2 = L_0 = 0 \tag{3.4}$$

through self-reference within this relationship which accompanies GOD's imagination (spin *i*) in Godhead. 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 $A^\mu = (\phi, \mathbf{A})$, equation (3.4) becomes the following for an elementary entity with electric charge $e$:

$$(E - e\phi)^2 - m^2 - (\mathbf{p} - e\mathbf{A})^2 = L_0 = 0 \tag{3.5}$$

One form of GOD's Matrix Law is derived through self-reference as follows:

$$L = 1 = \frac{E^2 - m^2}{\mathbf{p}^2} = \left(\frac{E-m}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E+m}\right)^{-1} \tag{3.6}$$

$$\rightarrow \frac{E-m}{-|\mathbf{p}|} = \frac{-|\mathbf{p}|}{E+m} \rightarrow \frac{E-m}{-|\mathbf{p}|} - \frac{-|\mathbf{p}|}{E+m} = 0$$

where $|\mathbf{p}| = \sqrt{\mathbf{p}^2}$. Matrixing left-land side of the last expression in (3.6) such that $\mathrm{Det}(L^M) = E^2 - m^2 - \mathbf{p}^2 = 0$ so as to satisfy the fundamental relationship (3.4) in the determinant view, we have:

$$\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.7}$$

Indeed, expression (3.7) can also be obtained from expression (3.4) through self-reference as follows:

$$0 = E^2 - m^2 - \mathbf{p}^2 = Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + Det\begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix} \tag{3.8}$$

Matrixing expression (3.8) by removing determinant sign *Det*, we have:

$$\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + \begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix} = \begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.9}$$

After fermionic spinization:

$$|\mathbf{p}| = \sqrt{\mathbf{p}^2} = \sqrt{-Det(\boldsymbol{\sigma}\cdot\mathbf{p})} \rightarrow \boldsymbol{\sigma}\cdot\mathbf{p} \tag{3.10}$$

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

$$\sigma_1 = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad \sigma_2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \quad \sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \tag{3.11}$$

expression (3.7) becomes:

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M = E - \boldsymbol{\alpha}\bullet\mathbf{p} - \beta\mathrm{m} = E - H \tag{3.12}$$

where $\boldsymbol{\alpha} = (\alpha_1, \alpha_2, \alpha_3)$ and $\beta$ 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. Bosonic Spinization of expression (3.7) $|\mathbf{p}| = \sqrt{\mathbf{p}^2} \longrightarrow \mathbf{s}\cdot\mathbf{p}$ shall be discussed later.

If we define:

$$Det_\sigma \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} = (E-m)(E+m) - (-\boldsymbol{\sigma}\cdot\mathbf{p})(-\boldsymbol{\sigma}\cdot\mathbf{p}) \tag{3.13}$$

We get:

$$Det_\sigma \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} = \left(E^2 - m^2 - \mathbf{p}^2\right) I_2 = 0 \tag{3.14}$$

Thus, fundamental relationship (3.4) is also satisfied under the determinant view of expression (3.13). Indeed, we can also obtain the following conventional determinant:

$$Det \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} = \left(E^2 - m^2 - \mathbf{p}^2\right)^2 = 0 \tag{3.15}$$

One kind of metamorphoses of expressions (3.6) - (3.14) is respectively as follows:

$$L = 1 = \frac{E^2 - \mathbf{p}^2}{m^2} = \left(\frac{E - |\mathbf{p}|}{-m}\right)\left(\frac{-m}{E + |\mathbf{p}|}\right)^{-1} \tag{3.16}$$

$$\rightarrow \frac{E - |\mathbf{p}|}{-m} = \frac{-m}{E + |\mathbf{p}|} \rightarrow \frac{E - |\mathbf{p}|}{-m} - \frac{-m}{E + |\mathbf{p}|} = 0$$

$$\begin{pmatrix} E - |\mathbf{p}| & -m \\ -m & E + |\mathbf{p}| \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.17}$$

$$0 = E^2 - m^2 - \mathbf{p}^2 = Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + Det\begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix} \tag{3.18}$$

$$\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + \begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix} = \begin{pmatrix} E - |\mathbf{p}| & -m \\ -m & E + |\mathbf{p}| \end{pmatrix} \tag{3.19}$$

$$\begin{pmatrix} E - \boldsymbol{\sigma}\cdot\mathbf{p} & -m \\ -m & E + \boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.20}$$

$$Det_\sigma\begin{pmatrix} E - \boldsymbol{\sigma}\cdot\mathbf{p} & -m \\ -m & E + \boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} = (E - \boldsymbol{\sigma}\cdot\mathbf{p})(E + \boldsymbol{\sigma}\cdot\mathbf{p}) - (-m)(-m) \tag{3.21}$$

$$Det_\sigma\begin{pmatrix} E - \boldsymbol{\sigma}\cdot\mathbf{p} & -m \\ -m & E + \boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} = (E^2 - \mathbf{p}^2 - m^2)I_2 = 0 \tag{3.22}$$

Expression (3.17) is the unspinized Matrix Law in Weyl (chiral) form and it is connected to expression (3.7) by Hadamard matrix $H = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & 1 \\ 1 & -1 \end{pmatrix}$:

$$H\begin{pmatrix} E - m & -|\mathbf{p}| \\ -|\mathbf{p}| & E + m \end{pmatrix}H^{-1} = \begin{pmatrix} E - |\mathbf{p}| & -m \\ -m & E + |\mathbf{p}| \end{pmatrix} \tag{3.23}$$

Expression (3.20) is spinized Matrix Law in Weyl (chiral) form and it is connected to expression (3.12) by 4x4 Hadamard matrix:

$$H\begin{pmatrix} E - m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E + m \end{pmatrix}H^{-1} = \begin{pmatrix} E - \boldsymbol{\sigma}\cdot\mathbf{p} & -m \\ -m & E + \boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} \tag{3.24}$$

Another kind of metamorphoses of expressions (3.6) - (3.14) is respectively as follows:

$$L = 1 = \frac{E^2}{m^2 + \mathbf{p}^2} = \left(\frac{E}{-m + i|\mathbf{p}|}\right)\left(\frac{-m - i|\mathbf{p}|}{E}\right)^{-1} \tag{3.25}$$

$$\rightarrow \frac{E}{-m + i|\mathbf{p}|} = \frac{-m - i|\mathbf{p}|}{E} \rightarrow \frac{E}{-m + i|\mathbf{p}|} - \frac{-m - i|\mathbf{p}|}{E} = 0$$

$$\begin{pmatrix} E & -m - i|\mathbf{p}| \\ -m + i|\mathbf{p}| & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.26}$$

$$0 = E^2 - m^2 - \mathbf{p}^2 = Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + Det\begin{pmatrix} 0 & -i|\mathbf{p}| \\ i|\mathbf{p}| & 0 \end{pmatrix} \tag{3.27}$$

$$\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + \begin{pmatrix} 0 & -i|\mathbf{p}| \\ i|\mathbf{p}| & 0 \end{pmatrix} = \begin{pmatrix} E & -m - i|\mathbf{p}| \\ -m + i|\mathbf{p}| & E \end{pmatrix} \tag{3.28}$$

$$\begin{pmatrix} E & -m - i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m + i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.29}$$

$$Det_\sigma\begin{pmatrix} E & -m - i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m + i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} = EE - (-m - i\boldsymbol{\sigma}\cdot\mathbf{p})(-m + i\boldsymbol{\sigma}\cdot\mathbf{p}) \tag{3.30}$$

$$Det_\sigma\begin{pmatrix} E & -m - i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m + i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} = (E^2 - m^2 - \mathbf{p}^2)I_2 = 0 \tag{3.31}$$

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:

$$\begin{pmatrix} E & -Q \\ -Q^* & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.32}$$

Expression (3.26) is connected to expression (3.7) by unitary matrix $HS = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & i \\ 1 & -i \end{pmatrix}$:

$$HS\begin{pmatrix} E - m & -|\mathbf{p}| \\ -|\mathbf{p}| & E + m \end{pmatrix}(HS)^{-1} = \begin{pmatrix} E & -m - i|\mathbf{p}| \\ -m + i|\mathbf{p}| & E \end{pmatrix} \tag{3.33}$$

Similarly, expression (3.12) is connected to expression (3.29) by 4x4 matrix *HS*:

$$HS\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix}(HS)^{-1} = \begin{pmatrix} E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \tag{3.34}$$

Yet another kind of metamorphoses of expressions (3.6), (3.7) & (3.12) is respectively as follows:

$$L = 1 = \frac{E^2 - m^2}{\mathbf{p}^2} = \left(\frac{E+m}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E-m}\right)^{-1} \tag{3.35}$$

$$\rightarrow \frac{E+m}{-|\mathbf{p}|} = \frac{-|\mathbf{p}|}{E-m} \rightarrow \frac{E+m}{-|\mathbf{p}|} - \frac{-|\mathbf{p}|}{E-m} = 0$$

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

$$\begin{pmatrix} E+m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E-m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M = E - \boldsymbol{\alpha}\bullet\mathbf{p} + \beta m \tag{3.37}$$

If $m$=0, we have from expressions (3.6) - (3.14):

$$L = 1 = \frac{E^2}{\mathbf{p}^2} = \left(\frac{E}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E}\right)^{-1} \tag{3.38}$$

$$\rightarrow \frac{E}{-|\mathbf{p}|} = \frac{-|\mathbf{p}|}{E} \rightarrow \frac{E}{-|\mathbf{p}|} - \frac{-|\mathbf{p}|}{E} = 0$$

$$\begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.39}$$

$$0 = E^2 - \mathbf{p}^2 = Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix} \tag{3.40}$$

$$\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix} = \begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix} \tag{3.41}$$

After fermionic spinization $|\mathbf{p}| \rightarrow \boldsymbol{\sigma}\cdot\mathbf{p}$, expression (3.39) becomes:

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.42}$$

which governs massless fermion (neutrino) in Dirac form.

After bosonic spinization:

$$|\mathbf{p}| = \sqrt{\mathbf{p}^2} = \sqrt{-(Det(\mathbf{s}\cdot\mathbf{p}+I_3)-Det(I_3))} \rightarrow \mathbf{s}\cdot\mathbf{p} \tag{3.43}$$

expression (3.39) becomes:

$$\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.44}$$

where $\mathbf{s} = (s_1, s_2, s_3)$ are spin operators for spin 1 particle:

$$s_1 = \begin{pmatrix} 0 & 0 & 0 \\ 0 & 0 & -i \\ 0 & i & 0 \end{pmatrix} \quad s_2 = \begin{pmatrix} 0 & 0 & i \\ 0 & 0 & 0 \\ -i & 0 & 0 \end{pmatrix} \quad s_3 = \begin{pmatrix} 0 & -i & 0 \\ i & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix} \tag{3.45}$$

If we define:

$$Det_s\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} = (E)(E) - (-\mathbf{s}\cdot\mathbf{p})(-\mathbf{s}\cdot\mathbf{p}) \tag{3.46}$$

We get:

$$Det_s\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} = \left(E^2 - \mathbf{p}^2\right)I_3 - \begin{pmatrix} p_x^2 & p_x p_y & p_x p_z \\ p_y p_x & p_y^2 & p_y p_z \\ p_z p_x & p_z p_y & p_z^2 \end{pmatrix} \tag{3.47}$$

To obey fundamental relationship (3.4) in determinant view (3.46), we shall require the last term in (3.47) acting on the external and internal wave functions respectively to produce null result (zero) in source-free zone as discussed later. We propose that expression (3.39) governs massless particle with unobservable spin (spinless). After bosonic spinization, the spinless and massless particle gains its spin 1.

Another kind of metamorphoses of expressions (3.18) - (3.22) when $m$=0 is respectively as follows:

$$0 = E^2 - \mathbf{p}^2 = Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix} \tag{3.48}$$

$$\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix} = \begin{pmatrix} E-|\mathbf{p}| & 0 \\ 0 & E+|\mathbf{p}| \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.49}$$

$$\begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p} & 0 \\ 0 & E+\boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.50}$$

$$\begin{pmatrix} E-\mathbf{s}\cdot\mathbf{p} & 0 \\ 0 & E+\mathbf{s}\cdot\mathbf{p} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.51}$$

$$Det_s\begin{pmatrix} E-\mathbf{s}\cdot\mathbf{p} & 0 \\ 0 & E+\mathbf{s}\cdot\mathbf{p} \end{pmatrix} = (E - \mathbf{s}\cdot\mathbf{p})(E + \mathbf{s}\cdot\mathbf{p}) \tag{3.52}$$

$$Det_s\begin{pmatrix} E-\mathbf{s}\cdot\mathbf{p} & 0 \\ 0 & E+\mathbf{s}\cdot\mathbf{p} \end{pmatrix} = \left(E^2 - \mathbf{p}^2\right)I_3 - \begin{pmatrix} p_x^2 & p_x p_y & p_x p_z \\ p_y p_x & p_y^2 & p_y p_z \\ p_z p_x & p_z p_y & p_z^2 \end{pmatrix} \tag{3.53}$$

Again, we shall require the last term in expression (3.53) acting on external and internal wave functions respectively to produce null result (zero) in source-free zone in order to satisfy fundamental relationship (3.4) in the determinant view (3.52) as further discussed later.

Importantly, if $E$=0, we have from expression (3.4):

$$-m^2 - \mathbf{p}^2 = 0 \tag{3.54}$$

Thus, if GOD allows timeless forms of Matrix Law, we can derive, for example, from (3.7) and (3.17) the following:

$$\begin{pmatrix} -m & -|\mathbf{p}| \\ -|\mathbf{p}| & +m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.55}$$

$$\begin{pmatrix} -|\mathbf{p}| & -m \\ -m & +|\mathbf{p}| \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.56}$$

The above forms further degenerate, if $m$=0, as in the case of a massless particle.

Further, if |**p**|=0, we have from expression (3.4):

$$E^2 - m^2 = 0 \tag{3.57}$$

Thus, if GOD allows spaceless forms of Matrix Law, we can derive, for example, from (3.7) and (3.17) the following:

$$\begin{pmatrix} E-m & 0 \\ 0 & E+m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.58}$$

$$\begin{pmatrix} E & -m \\ -m & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{3.59}$$

The significance of these forms of Matrix Law shall be made clear later. We suggest for now that the timeless forms of Matrix Law govern external and internal wave functions (self-fields) which play the roles of timeless gravitons, that is, they mediate time-independent interactions through space (momentum) quantum entanglement. On the other hand, the 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.

The above metamorphoses of GOD's self-referential Matrix Law are derived from one-tier matrixization (self-reference) and two-tier matrixization (self-reference) based on the fundamental relationship (3.4). The first-tier matrixization makes distinctions in time (energy), proper time (mass) and undifferentiated space (total momentum) which involve scalar unit 1 and imaginary unit (spin) *i*. Then the second-tier matrixization makes distinction in three-dimensional space (three-dimensional momentum) based on spin $\boldsymbol{\sigma}$, $\boldsymbol{s}$ or other spin structure if it exists.

### 3.3 Additional Forms of Matrix Law

If GOD allows partial distinction within first-tier self-referential matrixization, we obtain, for example, the following additional forms of Matrix Law $\begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M$:

$$\begin{pmatrix} \sqrt{E^2-m^2} & -|\mathbf{p}| \\ -|\mathbf{p}| & \sqrt{E^2-m^2} \end{pmatrix} \quad (3.60) \qquad \begin{pmatrix} \sqrt{E^2-m^2} & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & \sqrt{E^2-m^2} \end{pmatrix} \quad (3.61)$$

$$\begin{pmatrix} \sqrt{E^2-m^2}-|\mathbf{p}| & 0 \\ 0 & \sqrt{E^2-m^2}+|\mathbf{p}| \end{pmatrix} \quad (3.62) \qquad \begin{pmatrix} \sqrt{E^2-m^2}-\boldsymbol{\sigma}\cdot\mathbf{p} & 0 \\ 0 & \sqrt{E^2-m^2}+\boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} \quad (3.63)$$

$$\begin{pmatrix} \sqrt{E^2-\mathbf{p}^2} & -m \\ -m & \sqrt{E^2-\mathbf{p}^2} \end{pmatrix} \quad (3.64) \qquad \begin{pmatrix} \sqrt{E^2-\mathbf{p}^2}-m & 0 \\ 0 & \sqrt{E^2-\mathbf{p}^2}+m \end{pmatrix} \quad (3.65)$$

$$\begin{pmatrix} E & -\sqrt{m^2+\mathbf{p}^2} \\ \sqrt{m^2+\mathbf{p}^2} & E \end{pmatrix} \quad (3.66) \qquad \begin{pmatrix} E-\sqrt{m^2+\mathbf{p}^2} & 0 \\ 0 & E+\sqrt{m^2+\mathbf{p}^2} \end{pmatrix} \quad (3.67)$$

$$\begin{pmatrix} \sqrt{E^2-m^2-\mathbf{p}^2} & 0 \\ 0 & \sqrt{E^2-m^2-\mathbf{p}^2} \end{pmatrix} \quad (3.68)$$

Bosonic versions of expressions (3.61) and (3.63) are obtained by replacing $\boldsymbol{\sigma}$ with $\mathbf{s}$.

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

$$m^2 - E^2 = -\mathbf{p}_i^2 = -p_{i,1}^2 - p_{i,2}^2 - p_{i,3}^2 = (i\mathbf{p}_i)^2 = -Det(\boldsymbol{\sigma} \cdot i\mathbf{p}_i) \quad (3.69)$$

that is:

$$E^2 - m^2 - \mathbf{p}_i^2 = 0 \quad (3.70)$$

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

$$\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \quad (3.71)$$

$$\begin{pmatrix} -m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i \\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & +m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \quad (3.72)$$

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

$$\begin{pmatrix} E-|\mathbf{p}_i| & -m \\ -m & +|\mathbf{p}_i| \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \quad (3.73)$$

$$\begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \quad (3.74)$$

Bosonic versions of expressions (3.72) and (3.74) are obtained by replacing $\boldsymbol{\sigma}$ with $\mathbf{s}$. It is likely that the above additional forms of self-referential Matrix Law govern different particles in the particle zoo as discussed later.

### 3.4 Scientific Genesis of Primordial Entities (Elementary Particles)

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

$$1 = e^h = e^{i0} = 1e^{i0} = Le^{-iM+iM} = \frac{E^2 - m^2}{\mathbf{p}^2} e^{-ip^\mu x_\mu + ip^\mu x_\mu} = \tag{3.75}$$

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

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

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

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

that is:

$$\begin{pmatrix} (E-m)\psi_{e,+} = \boldsymbol{\sigma}\cdot\mathbf{p}\,\psi_{i,-} \\ (E+m)\psi_{i,-} = \boldsymbol{\sigma}\cdot\mathbf{p}\,\psi_{e,+} \end{pmatrix} \text{ or } \begin{pmatrix} i\partial_t \psi_{e,+} - m\psi_{e,+} = -i\boldsymbol{\sigma}\cdot\nabla\psi_{i,-} \\ i\partial_t \psi_{i,-} + m\psi_{i,-} = -i\boldsymbol{\sigma}\cdot\nabla\psi_{e,+} \end{pmatrix} \tag{3.76}$$

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. Equation (3.76) also has free spherical wave solution in the form:

$$\psi = \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} \tag{3.77}$$

Alternatively, GOD creates, sustains and causes evolution of a free plane-wave fermion such as the electron in Dirac form as follows:

$$0 = 0e^h = 0e^{i0} = L_0 e^{-iM+iM} = \left(E^2 - m^2 - \mathbf{p}^2\right) e^{-ip^\mu x_\mu + ip^\mu x_\mu} = \tag{3.78}$$

$$\left(Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + Det\begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + \begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix}\right)\begin{pmatrix} a_{e,+}e^{-ip^{\mu}x_{\mu}} \\ a_{i,-}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} a_{e,+}e^{-ip^{\mu}x_{\mu}} \\ a_{i,-}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = 0$$

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

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

$$1 = e^h = e^{i0} = 1e^{i0} = Le^{+iM-iM} = \frac{E^2-m^2}{\mathbf{p}^2}e^{+ip^{\mu}x_{\mu}-ip^{\mu}x_{\mu}} = \tag{3.79}$$

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

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

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

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

or

$$0 = 0e^h = 0e^{i0} = L_0 e^{-iM+iM} = \left(E^2 - m^2 - \mathbf{p}^2\right)e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} = \tag{3.80}$$

$$\left(Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + Det\begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix}\right)\left(e^{+ip^{\mu}x_{\mu}}\right)\left(e^{+ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + \begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix}\right)\begin{pmatrix} a_{e,-}e^{+ip^{\mu}x_{\mu}} \\ a_{i,+}e^{+ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} a_{e,-}e^{+ip^{\mu}x_{\mu}} \\ a_{i,+}e^{+ip^{\mu}x_{\mu}} \end{pmatrix} = 0$$

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

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

$$1 = e^{h} = e^{i0} = 1e^{i0} = Le^{-iM+iM} = \frac{E^2-\mathbf{p}^2}{m^2}e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} =$$

$$\left(\frac{E-|\mathbf{p}|}{-m}\right)\left(\frac{-m}{E+|\mathbf{p}|}\right)^{-1}\left(e^{-ip^{\mu}x_{\mu}}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow \tag{3.81}$$

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

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

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

that is:

$$\begin{pmatrix} (E-\boldsymbol{\sigma}\cdot\mathbf{p})\psi_{e,l} = m\psi_{i,r} \\ (E+\boldsymbol{\sigma}\cdot\mathbf{p})\psi_{i,r} = m\psi_{e,l} \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} i\partial_t\psi_{e,l} + i\boldsymbol{\sigma}\cdot\nabla\psi_{e,l} = m\psi_{i,r} \\ i\partial_t\psi_{i,r} - i\boldsymbol{\sigma}\cdot\nabla\psi_{i,-} = m\psi_{e,l} \end{pmatrix} \tag{3.82}$$

Alternatively, GOD creates, sustains and causes evolution of a free plane-wave fermion in Weyl (chiral) form as follows:

$$0 = 0e^{h} = 0e^{i0} = L_0 e^{-iM+iM} = \left(E^2 - m^2 - \mathbf{p}^2\right) e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} = \tag{3.83}$$

$$\left(Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + Det\begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + \begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix}\right)\begin{pmatrix} a_{e,l} e^{-ip^{\mu}x_{\mu}} \\ a_{i,r} e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} E-|\mathbf{p}| & -m \\ -m & E+|\mathbf{p}| \end{pmatrix}\begin{pmatrix} a_{e,l} e^{-ip^{\mu}x_{\mu}} \\ a_{i,r} e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = 0$$

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

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

$$1 = e^{h} = e^{i0} = 1e^{i0} = Le^{-iM+iM} = \frac{E^2}{m^2+\mathbf{p}^2} e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} = \tag{3.84}$$

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

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

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

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

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

that is:

$$\begin{pmatrix} E\psi_e = (m + i\boldsymbol{\sigma}\cdot\mathbf{p})\psi_i \\ E\psi_i = (m - i\boldsymbol{\sigma}\cdot\mathbf{p})\psi_e \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} i\partial_t\psi_e = m\psi_i + \boldsymbol{\sigma}\cdot\nabla\psi_i \\ i\partial_t\psi_i = m\psi_e - \boldsymbol{\sigma}\cdot\nabla\psi_i \end{pmatrix} \tag{3.85}$$

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

$$0 = 0e^h = 0e^{i0} = L_0 e^{-iM+iM} = \left(E^2 - m^2 - \mathbf{p}^2\right)e^{-ip^\mu x_\mu + ip^\mu x_\mu} =$$

$$\left(Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + Det\begin{pmatrix} 0 & -i|\mathbf{p}| \\ i|\mathbf{p}| & 0 \end{pmatrix}\right)\left(e^{-ip^\mu x_\mu}\right)\left(e^{-ip^\mu x_\mu}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix} + \begin{pmatrix} 0 & -i|\mathbf{p}| \\ i|\mathbf{p}| & 0 \end{pmatrix}\right)\begin{pmatrix} a_e e^{-ip^\mu x_\mu} \\ a_i e^{-ip^\mu x_\mu} \end{pmatrix} = \begin{pmatrix} E & -m - i|\mathbf{p}| \\ -m + i|\mathbf{p}| & E \end{pmatrix}\begin{pmatrix} a_e e^{-ip^\mu x_\mu} \\ a_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$$

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

$$\rightarrow \begin{pmatrix} E & -Q \\ -Q^* & E \end{pmatrix}\begin{pmatrix} A_e e^{-ip^\mu x_\mu} \\ A_i e^{-ip^\mu x_\mu} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = L_M\psi = 0 \tag{3.86}$$

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

$$1 = e^h = e^{i0} = 1e^{i0} = Le^{-iM+iM} = \frac{E^2}{\mathbf{p}^2}e^{-ip^\mu x_\mu + ip^\mu x_\mu} =$$

$$\left(\frac{E}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{E}\right)^{-1}\left(e^{-ip^\mu x_\mu}\right)\left(e^{-ip^\mu x_\mu}\right)^{-1} \rightarrow \tag{3.87}$$

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

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

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

Alternatively, GOD creates, sustains and causes evolution of the linear plane-wave photon as follows:

$$0 = 0e^{h} = 0e^{i0} = L_0 e^{-iM+iM} = \left(E^2 - \mathbf{p}^2\right) e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} = \tag{3.88}$$

$$\left( Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix} \right) \left( e^{-ip^{\mu}x_{\mu}} \right) \left( e^{-ip^{\mu}x_{\mu}} \right)^{-1} \rightarrow$$

$$\left( \begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix} \right) \begin{pmatrix} a_{e,+} e^{-ip^{\mu}x_{\mu}} \\ a_{i,-} e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix} \begin{pmatrix} a_{e,+} e^{-ip^{\mu}x_{\mu}} \\ a_{i,-} e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = 0$$

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

This photon wave function can be written as:

$$\psi_{photon} = \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = \begin{pmatrix} \mathbf{E} \\ i\mathbf{B} \end{pmatrix} = \begin{pmatrix} \mathbf{E}_{\mathbf{0}} e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \\ i\mathbf{B}_{\mathbf{0}} e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \end{pmatrix} = \begin{pmatrix} \mathbf{E}_{\mathbf{0}} \\ i\mathbf{B}_{\mathbf{0}} \end{pmatrix} e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \tag{3.89}$$

After the substitutions $E \rightarrow i\partial_t$ and $\mathbf{p} \rightarrow -i\nabla$, we have from last expression in (3.87):

$$\begin{pmatrix} i\partial_t & i\mathbf{s}\cdot\nabla \\ i\mathbf{s}\cdot\nabla & i\partial_t \end{pmatrix} \begin{pmatrix} \mathbf{E} \\ i\mathbf{B} \end{pmatrix} = 0 \rightarrow \begin{pmatrix} \partial_t \mathbf{E} = \nabla\times\mathbf{B} \\ \partial_t \mathbf{B} = -\nabla\times\mathbf{E} \end{pmatrix} \tag{3.90}$$

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.

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

$$\rightarrow \begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} a_{e,+} e^{-ip^{\mu}x_{\mu}} \\ a_{i,-} e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = L_M \psi = 0 \qquad (3.91)$$

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

$$1 = e^{h} = e^{i0} = 1e^{i0} = Le^{-iM+iM} = \frac{E^2}{\mathbf{p}^2} e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} =$$

$$(3.92)$$

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

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

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

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

This antiphoton wave function can also be written as:

$$\psi_{antiphoton} = \begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = \begin{pmatrix} i\mathbf{B} \\ \mathbf{E} \end{pmatrix} = \begin{pmatrix} i\mathbf{B}_{\mathbf{0}} e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \\ \mathbf{E}_{\mathbf{0}} e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \end{pmatrix} = \begin{pmatrix} i\mathbf{B}_{\mathbf{0}} \\ \mathbf{E}_{\mathbf{0}} \end{pmatrix} e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \qquad (3.93)$$

GOD creates an anti-neutrino in Dirac form, if GOD does, by replacing the last step of expression (3.93) with the following:

$$\rightarrow \begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} a_{e,-} e^{+ip^{\mu}x_{\mu}} \\ a_{i,+} e^{+ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = L_M \psi = 0 \qquad (3.94)$$

GOD creates, sustains and causes evolution of chiral plane-wave photons as follows:

$$0 = 0e^{h} = 0e^{i0} = L_0 e^{-iM+iM} = \left(E^2 - \mathbf{p}^2\right) e^{-ip^{\mu}x_{\mu}+ip^{\mu}x_{\mu}} = \tag{3.95}$$

$$\left( Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)\left(e^{-ip^{\mu}x_{\mu}}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & |\mathbf{p}| \end{pmatrix}\right)\begin{pmatrix} a_{e,l} e^{-ip^{\mu}x_{\mu}} \\ a_{i,r} e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} E-|\mathbf{p}| & 0 \\ 0 & E+|\mathbf{p}| \end{pmatrix}\begin{pmatrix} a_{e,l} e^{-ip^{\mu}x_{\mu}} \\ a_{i,r} e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = 0$$

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

that is, $\psi_{e,l}$ and $\psi_{i,r}$ are decoupled from each other and satisfy the following equations respectively:

$$\begin{pmatrix} (E - \mathbf{s}\cdot\mathbf{p})\psi_{e,l} = 0 \\ (E + \mathbf{s}\cdot\mathbf{p})\psi_{i,r} = 0 \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} \partial_t \psi_{e,l} + \mathbf{s}\cdot\nabla\psi_{e,l} = 0 \\ \partial_t \psi_{i,r} - \mathbf{s}\cdot\nabla\psi_{i,r} = 0 \end{pmatrix} \tag{3.96}$$

which have the following respective solutions:

$$\psi = \begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = \begin{pmatrix} \mathbf{E} + i\mathbf{B} \\ \mathbf{E} - i\mathbf{B} \end{pmatrix} = \begin{pmatrix} \left(\mathbf{E_0} + i\mathbf{B_0}\right) e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \\ \left(\mathbf{E_0} - i\mathbf{B_0}\right) e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \end{pmatrix} \tag{3.97}$$

Both $\partial_t \psi_{e,l} + \mathbf{s}\cdot\nabla\psi_{e,l} = 0$ and $\partial_t \psi_{i,r} - \mathbf{s}\cdot\nabla\psi_{i,r} = 0$ produce the Maxwell equation in the source-free vacuum as shown in the second expression of (3.90).

GOD creates neutrinos in Weyl (chiral) forms, if GOD does, by replacing the last step of expression (3.95) with the following:

$$\rightarrow \begin{pmatrix} E-\sigma\cdot\mathbf{p} & 0 \\ 0 & E+\sigma\cdot\mathbf{p} \end{pmatrix}\begin{pmatrix} A_{e,l} e^{-ip^{\mu}x_{\mu}} \\ A_{i,r} e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M \psi = 0 \tag{3.98}$$

that is, $\psi_{e,l}$ and $\psi_{i,r}$ are decoupled from each other and satisfy the following equations respectively:

$$\begin{pmatrix} (E - \boldsymbol{\sigma}\cdot\mathbf{p})\psi_{e,l} = 0 \\ (E + \boldsymbol{\sigma}\cdot\mathbf{p})\psi_{i,r} = 0 \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} \partial_t \psi_{e,l} + \boldsymbol{\sigma}\cdot\nabla\psi_{e,l} = 0 \\ \partial_t \psi_{i,r} - \boldsymbol{\sigma}\cdot\nabla\psi_{i,r} = 0 \end{pmatrix} \tag{3.99}$$

GOD likely creates and sustains timeless (instantaneous) external and internal wave functions (timeless graviton) of a mass *m* in Dirac form as follows:

$$1 = e^{h} = e^{i0} = 1e^{i0} = Le^{-iM+iM} = \frac{-m^2}{\mathbf{p}^2} e^{-iM+iM} = \tag{3.100}$$

$$\left(\frac{-m}{-|\mathbf{p}|}\right)\left(\frac{-|\mathbf{p}|}{+m}\right)^{-1}\left(e^{-iM}\right)\left(e^{-iM}\right)^{-1} \rightarrow$$

$$\frac{-m}{-|\mathbf{p}|} e^{-iM} = \frac{-|\mathbf{p}|}{+m} e^{-iM} \rightarrow \frac{-m}{-|\mathbf{p}|} e^{-iM} - \frac{-|\mathbf{p}|}{+m} e^{-iM} = 0$$

$$\rightarrow \begin{pmatrix} -m & -|\mathbf{p}| \\ -|\mathbf{p}| & +m \end{pmatrix}\begin{pmatrix} g_{D,e}e^{-iM} \\ g_{D,i}e^{-iM} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = L_M V_D = 0$$

We will determine the form of imaginary content $M$ in expression (3.100) later.

Alternatively, GOD likely creates and sustains timeless (instantaneous) external and internal wave functions (timeless graviton) of a mass $m$ in Dirac form as follows:

$$0 = 0e^{h} = 0e^{i0} = L_0 e^{-iM+iM} = \left(m^2 - \mathbf{p}^2\right)e^{-iM+iM} = \tag{3.101}$$

$$\left(Det\begin{pmatrix} -m & 0 \\ 0 & +m \end{pmatrix} + Det\begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix}\right)\left(e^{-iM}\right)\left(e^{-iM}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} -m & 0 \\ 0 & +m \end{pmatrix} + \begin{pmatrix} 0 & -|\mathbf{p}| \\ -|\mathbf{p}| & 0 \end{pmatrix}\right)\begin{pmatrix} g_{D,e}e^{-iM} \\ g_{D,i}e^{-iM} \end{pmatrix} = \begin{pmatrix} -m & -|\mathbf{p}| \\ -|\mathbf{p}| & +m \end{pmatrix}\begin{pmatrix} g_{D,e}e^{-iM} \\ g_{D,i}e^{-iM} \end{pmatrix} = 0$$

Similarly, GOD likely creates and sustains timeless (instantaneous) external and internal wave functions (timeless graviton) of a mass $m$ in Weyl (chiral) form as follows:

$$1 = e^{h} = e^{i0} = 1e^{i0} = Le^{-iM+iM} = \frac{-m^2}{\mathbf{p}^2} e^{-iM+iM} = \tag{3.102}$$

$$\left(\frac{-|\mathbf{p}|}{-m}\right)\left(\frac{-m}{+|\mathbf{p}|}\right)^{-1}\left(e^{-iM}\right)\left(e^{-iM}\right)^{-1} \rightarrow$$

$$\frac{-|\mathbf{p}|}{-m} e^{-iM} = \frac{-m}{+|\mathbf{p}|} e^{-iM} \rightarrow \frac{-|\mathbf{p}|}{-m} e^{-iM} - \frac{-m}{+|\mathbf{p}|} e^{-iM} = 0$$

$$\rightarrow \begin{pmatrix} -|\mathbf{p}| & -m \\ -m & +|\mathbf{p}| \end{pmatrix}\begin{pmatrix} g_{W,e}e^{-iM} \\ g_{W,i}e^{-iM} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = L_M V_W = 0$$

Again, we will determine the form of the imaginary content $M$ in expression (3.102) later.

Alternatively, GOD likely creates and sustains timeless (instantaneous) external and internal wave functions (timeless graviton) of a mass *m* in Weyl (chiral) form as follows:

$$0 = 0e^{h} = 0e^{i0} = L_0 e^{-iM+iM} = \left(m^2 - \mathbf{p}^2\right)e^{-iM+iM} = \tag{3.103}$$

$$\left(Det\begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & +|\mathbf{p}| \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix}\right)\left(e^{-iM}\right)\left(e^{-iM}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} -|\mathbf{p}| & 0 \\ 0 & +|\mathbf{p}| \end{pmatrix} + \begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix}\right)\begin{pmatrix} g_{W,e}e^{-iM} \\ g_{W,i}e^{-iM} \end{pmatrix} = \begin{pmatrix} -m & -|\mathbf{p}| \\ -|\mathbf{p}| & +m \end{pmatrix}\begin{pmatrix} g_{W,e}e^{-iM} \\ g_{w,i}e^{-iM} \end{pmatrix} = 0$$

GOD likely creates and sustains spaceless (space/distance independent) external and internal wave functions of a mass *m* in Dirac form as follows:

$$0 = 0e^{h} = 0e^{0} = L_0 e^{-iM+iM} = \left(E^2 - m^2\right)e^{-imt+imt} = \tag{3.104}$$

$$\left(Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} -m & 0 \\ 0 & +m \end{pmatrix}\right)\left(e^{-imt}\right)\left(e^{-imt}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} -m & 0 \\ 0 & +m \end{pmatrix}\right)\begin{pmatrix} g_{D,e}e^{-imt} \\ g_{D,i}e^{-imt} \end{pmatrix} = \begin{pmatrix} E-m & 0 \\ 0 & E+m \end{pmatrix}\begin{pmatrix} g_{D,e}e^{-imt} \\ g_{D,i}e^{-imt} \end{pmatrix} = 0$$

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

$$1 = e^{h} = e^{0} = 1e^{0} = Le^{-iM+iM} = \frac{E^2}{m^2}e^{-imt+imt} = \tag{3.105}$$

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

$$\frac{E}{-m}e^{-imt} = \frac{-m}{E}e^{-imt} \rightarrow \frac{E}{-m}e^{-imt} - \frac{-m}{E}e^{-imt} = 0$$

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

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

$$0 = 0e^{h} = 0e^{i0} = L_0 e^{-iM+iM} = \left(E^2 - m^2\right)e^{-imt+imt} = \tag{3.106}$$

$$\left(Det\begin{pmatrix} -E & 0 \\ 0 & +E \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix}\right)\left(e^{-imt}\right)\left(e^{-imt}\right)^{-1} \rightarrow$$

$$\left(\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix}\right)\begin{pmatrix} g_{W,e}e^{-imt} \\ g_{W,i}e^{-imt} \end{pmatrix} = \begin{pmatrix} E & -m \\ -m & E \end{pmatrix}\begin{pmatrix} g_{W,e}e^{-imt} \\ g_{w,i}e^{-imt} \end{pmatrix} = 0$$

GOD likely 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:

$$1 = e^{h} = e^{i0} = 1e^{i0} = Le^{+iM-iM} = \frac{E^2 - m^2}{\mathbf{p}_i^2}e^{+ip^{\mu}x_{\mu} - ip^{\mu}x_{\mu}} = \tag{3.107}$$

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

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

$$\rightarrow \begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix}\begin{pmatrix} s_{e,-}e^{+iEt} \\ s_{i,+}e^{+iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = L_M \psi = 0 \tag{3.108}$$

After spinization of expression (3.108), we have:

$$\rightarrow \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i \\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & E+m \end{pmatrix}\begin{pmatrix} S_{e,-}e^{+iEt} \\ S_{i,+}e^{+iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix} = L_M \psi = 0 \tag{3.109}$$

As discussed later, it is likely that express (3.108) governs the confinement structure of the unspinized proton in Dirac form through imaginary momentum $\mathbf{p}_i$ and, on the other hand, expression (3.109) governs the confinement structure of spinized proton through $\mathbf{p}_i$.

Alternatively, GOD likely creates, sustains and causes evolution of the spatially self-confined entity such as a proton in Dirac form as follows:

$$0 = 0e^{h} = 0e^{i0} = L_0 e^{iM-iM} = \left(E^2 - m^2 - \mathbf{p}_i^2\right)e^{+ip^{\mu}x_{\mu} - ip^{\mu}x_{\mu}} = \tag{3.110}$$

$$Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + \left( Det\begin{pmatrix} -m & 0 \\ 0 & m \end{pmatrix} + Det\begin{pmatrix} 0 & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & 0 \end{pmatrix}\right)\left(e^{+ip^\mu x_\mu}\right)\left(e^{+ip^\mu x_\mu}\right)^{-1} \rightarrow$$

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

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

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

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

$$\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix}\begin{pmatrix} s_{e,+}e^{-iEt} \\ s_{i,-}e^{-iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{D,e} \\ \psi_{D,i} \end{pmatrix} = L_M \psi_D = 0 \qquad (3.111)$$

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i \\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & E+m \end{pmatrix}\begin{pmatrix} S_{e,+}e^{-iEt} \\ S_{i,-}e^{-iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{D,e} \\ \psi_{D,i} \end{pmatrix} = L_M \psi_D = 0 \qquad (3.112)$$

Similarly, GOD likely 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:

$$1 = e^h = e^{i0} = 1e^{i0} = (L)_m e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \frac{E^2 - \mathbf{p}_i^2}{m^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \qquad (3.113)$$

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

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

$$\rightarrow \begin{pmatrix} E-|\mathbf{p}_i| & -m \\ -m & E+|\mathbf{p}_i| \end{pmatrix}\begin{pmatrix} s_{e,r}e^{+iEt} \\ s_{i,l}e^{+iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,r} \\ \psi_{i,l} \end{pmatrix} = L_M \psi = 0 \qquad (3.114)$$

After spinization of expression (3.114), we have:

$$\rightarrow\begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i \end{pmatrix}\begin{pmatrix} S_{e,r}e^{+iEt} \\ S_{i,l}e^{+iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,r} \\ \psi_{i,l} \end{pmatrix} = L_M\psi = 0 \tag{3.115}$$

It is likely that express (3.114) governs the structure of the unspinized proton in Weyl form and expression (3.115) governs the structure of spinized proton in Weyl form.

Alternatively, GOD likely creates, sustains and causes evolution of a spatially self-confined entity such as a proton in Weyl (chiral) form as follows:

$$0 = 0e^h = 0e^{i0} = L_0 e^{iM-iM} = \left(E^2 - m^2 - \mathbf{p}_i^2\right)e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \tag{3.116}$$

$$\left( Det\begin{pmatrix} E & 0 \\ 0 & E \end{pmatrix} + Det\begin{pmatrix} -|\mathbf{p}_i| & 0 \\ 0 & +|\mathbf{p}_i| \end{pmatrix} + Det\begin{pmatrix} 0 & -m \\ -m & 0 \end{pmatrix}\right)\left(e^{+ip^\mu x_\mu}\right)\left(e^{+ip^\mu x_\mu}\right)^{-1} \rightarrow$$

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

$$\rightarrow\begin{pmatrix} E-|\mathbf{p}_i| & -m \\ -m & E+|\mathbf{p}_i| \end{pmatrix}\begin{pmatrix} s_{e,r}e^{+iEt} \\ s_{i,l}e^{+iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,r} \\ \psi_{i,l} \end{pmatrix} = L_M\psi = 0 \tag{3.117}$$

$$\rightarrow\begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i \end{pmatrix}\begin{pmatrix} S_{e,r}e^{+iEt} \\ S_{i,l}e^{+iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,r} \\ \psi_{i,l} \end{pmatrix} = L_M\psi = 0 \tag{3.118}$$

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

$$\begin{pmatrix} E-|\mathbf{p}_i| & -m \\ -m & E+|\mathbf{p}_i| \end{pmatrix}\begin{pmatrix} s_{e,l}e^{-iEt} \\ s_{i,r}e^{-iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M\psi = 0 \tag{3.119}$$

$$\begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i \end{pmatrix}\begin{pmatrix} S_{e,l}e^{-iEt} \\ S_{i,r}e^{-iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M\psi = 0 \tag{3.120}$$

### 3.4 Scientific Genesis of Composite Entities

Then, GOD may create, sustain and cause evolution of a neutron in Dirac form which is comprised of an unspinized proton:

$$\left(\begin{pmatrix} E-e\phi-m & -|\mathbf{p}_i-e\mathbf{A}| \\ -|\mathbf{p}_i-e\mathbf{A}| & E-e\phi+m \end{pmatrix}\begin{pmatrix} s_{e,-}e^{+iEt} \\ s_{i,+}e^{+iEt} \end{pmatrix} = 0\right)_p \tag{3.121}$$

and a spinized electron:

$$\left(\begin{pmatrix} E+e\phi-V-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi-V+m \end{pmatrix}\begin{pmatrix} S_{e,+}e^{-iEt} \\ S_{i,-}e^{-iEt} \end{pmatrix}=0\right)_e \tag{3.122}$$

as follows:

$$1=e^h=e^{i0}e^{i0}=1e^{i0}1e^{i0}=\left(Le^{-iM+iM}\right)_p\left(Le^{-iM+iM}\right)_e \tag{3.123}$$

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

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

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

$$\to\left(\frac{E-m}{-|\mathbf{p}_i|}e^{+ip^\mu x_\mu}-\frac{-|\mathbf{p}_i|}{E+m}e^{+ip^\mu x_\mu}=0\right)_p\left(\frac{E-m}{-|\mathbf{p}|}e^{-ip^\mu x_\mu}-\frac{-|\mathbf{p}|}{E+m}e^{-ip^\mu x_\mu}=0\right)_e$$

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

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

In expressions (3.121), (3.122) and (3.123), $(\ )_p$, $(\ )_e$ 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 (3.123):

$$\to\left(\begin{array}{l}\left(\begin{pmatrix}E-m & -|\mathbf{p}_i|\\ -|\mathbf{p}_i| & E+m\end{pmatrix}\begin{pmatrix}s_{e,-}e^{+iEt}\\ s_{i,+}e^{+iEt}\end{pmatrix}=0\right)_p\\ \\ \left(\begin{pmatrix}E+e\phi-V-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi-V+m\end{pmatrix}\begin{pmatrix}S_{e,+}e^{-iEt}\\ S_{i,-}e^{-iEt}\end{pmatrix}=0\right)_e\end{array}\right)_n \tag{3.124}$$

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

The Weyl (chiral) form of the last expression in (3.123) and expression (3.124) are respectively as follows:

$$\left(\begin{array}{l}\left(\begin{pmatrix}-e\phi-|\mathbf{p}_i-e\mathbf{A}| & -m\\ -m & -e\phi+|\mathbf{p}_i-e\mathbf{A}|\end{pmatrix}\begin{pmatrix}s_{e,r}e^{+iEt}\\ s_{i,l}e^{+iEt}\end{pmatrix}=0\right)_p\\ \\ \left(\begin{pmatrix}E+e\phi-V-\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & -m\\ -m & E+e\phi-V+\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\end{pmatrix}\begin{pmatrix}S_{e,l}e^{-iEt}\\ S_{i,r}e^{-iEt}\end{pmatrix}=0\right)_e\end{array}\right)_n \tag{3.125}$$

$$\left(\begin{array}{l}\left(\begin{pmatrix}E-|\mathbf{p}_i| & -m\\ -m & E+|\mathbf{p}_i|\end{pmatrix}\begin{pmatrix}s_{e,r}e^{+iEt}\\ s_{i,l}e^{+iEt}\end{pmatrix}=0\right)_p\\ \\ \left(\begin{pmatrix}E+e\phi-V-\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & -m\\ -m & E+e\phi-V+\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\end{pmatrix}\begin{pmatrix}S_{e,l}e^{-iEt}\\ S_{i,r}e^{-iEt}\end{pmatrix}=0\right)_e\end{array}\right)_n \tag{3.126}$$

Then, GOD may create, sustain and cause evolution of a hydrogen atom comprising of a spinized proton:

$$\left(\begin{pmatrix}E-e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}_i-e\mathbf{A})\\ -\boldsymbol{\sigma}\cdot(\mathbf{p}_i-e\mathbf{A}) & E-e\phi+m\end{pmatrix}\begin{pmatrix}S_{e,-}e^{+iEt}\\ S_{i,+}e^{+iEt}\end{pmatrix}=0\right)_p \tag{3.127}$$

and a spinized electron:

$$\left(\begin{pmatrix}E+e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A})\\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi+m\end{pmatrix}\begin{pmatrix}S_{e,+}e^{-iEt}\\ S_{i,-}e^{-iEt}\end{pmatrix}=0\right)_e \tag{3.128}$$

in Dirac form as follows:

$$1 = e^h = e^{i0}e^{i0} = 1e^{i0}1e^{i0} = \left(Le^{-iM+iM}\right)_p \left(Le^{-iM+iM}\right)_e \tag{3.129}$$

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

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

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

$$\rightarrow \left(\frac{E-m}{-|\mathbf{p}_i|} e^{+ip^\mu x_\mu} - \frac{-|\mathbf{p}_i|}{E+m} e^{+ip^\mu x_\mu} = 0\right)_p \left(\frac{E-m}{-|\mathbf{p}|} e^{-ip^\mu x_\mu} - \frac{-|\mathbf{p}|}{E+m} e^{-ip^\mu x_\mu} = 0\right)_e$$

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

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

In expressions (3.127), (3.128) and (3.129), $(\ )_p$, $(\ )_e$ and $(\ )_h$ indicate proton, electron and hydrogen atom respectively. Again, 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 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):

$$\rightarrow \begin{pmatrix} \left( \begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i \\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} S_{e,-}e^{+iEt} \\ S_{i,+}e^{+iEt} \end{pmatrix} = 0 \right)_p \\ \\ \left( \begin{pmatrix} E+e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi+m \end{pmatrix} \begin{pmatrix} S_{e,+}e^{-iEt} \\ S_{i,-}e^{-iEt} \end{pmatrix} = 0 \right)_e \end{pmatrix}_h \tag{1.130}$$

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

$$\begin{pmatrix} \left( \begin{pmatrix} E-e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}_i-e\mathbf{A}) & -m \\ -m & E-e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}_i-e\mathbf{A}) \end{pmatrix} \begin{pmatrix} S_{e,r}e^{+iEt} \\ S_{i,l}e^{+iEt} \end{pmatrix} = 0 \right)_p \\ \\ \left( \begin{pmatrix} E+e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & -m \\ -m & E+e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \end{pmatrix} \begin{pmatrix} S_{e,l}e^{-iEt} \\ S_{i,r}e^{-iEt} \end{pmatrix} = 0 \right)_e \end{pmatrix}_h \tag{3.131}$$

$$\begin{pmatrix} \left( \begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i \end{pmatrix} \begin{pmatrix} S_{e,r}e^{+iEt} \\ S_{i,l}e^{+iEt} \end{pmatrix} = 0 \right)_p \\ \\ \left( \begin{pmatrix} E+e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & -m \\ -m & E+e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \end{pmatrix} \begin{pmatrix} S_{e,l}e^{-iEt} \\ S_{i,r}e^{-iEt} \end{pmatrix} = 0 \right)_e \end{pmatrix}_h \tag{3.132}$$

# 4. METAMORPHOUS GOD'S EYE VIEW

## 4.1. Metamorphoses & the Essence of Spin

The preceding sections make it clear that the GOD particle $e^0$ can take many different forms as different primordial entities and, further, can have different manifestations as different wave functions and/or fields in different contexts even as a single primordial entity. For example, the wave functions of an electron can take the Dirac, Weyl, quaternion or determinant form respectively in different contexts depending on the questions one asks and the answer one seeks. However, the answer one gets is determined by GOD's free will commonly termed as measurement problem and understood currently as the randomness of Nature. For another example, depending on the context, the manifestations of an entity such as an electron can take the form of a bi-spinor $(\psi, \psi)^T$ in spinized self-interaction and bi-vector $(\mathbf{E}, i\mathbf{B})^T$ or electromagnetic potential $A^u=(\phi, \mathbf{A})$ in electromagnetic interactions. Further, these forms are self-contained through their respective self-referential Matrix Law.

Now, if we ask the question how GOD creates a free fermion, we have shown several versions of it. If we ask the question how an entity participates in weak interaction, the answer is: through fermionic spinization and unspinization. If we ask the question how an entity participates in the strong interaction, the answer is: imaginary momentum (downward self-reference). If we ask the question how an entity participates in electromagnetic interaction, the answer is: through bosonic spinization and unspinization. If we ask the question, how an entity participates in gravitational interaction, the answer is: through timeless, spaceless and/or massless external and internal wave function in prespacetime.

Further, this work also makes it clear that primordial self-referential spin in prespacetime (GOD, ALLAH or Consciousness) is hierarchical and it is the cause of primordial distinctions for creating the self-referential entities in the dual world. There are several levels of spin: (1) spin in Godhead making primordial external and internal phase distinctions of external and internal wave functions; (2) spin of Godbody (aether) making primordial external and internal wave functions which accompanies the primordial phase distinctions; (3) self-referential mixing of these wave functions through Matrix Law before spatial spinization (energy/time spin); (4) unconfining spatial spin through spatial spinization (electromagnetic and weak interaction) for creating bosonic and fermionic entities; and (5) confining spatial spin (strong interactions) creating the appearance of quarks through imaginary momentum (downward self-reference).

### 4.2. The Determinant View & the Meaning of Klein-Gordon Equation

In the determinant view, the Matrix Law collapses into Klein-Gordon form as shown in § 3 but so far we have not defined the form of the wave function as a result of the said collapse. Here, we propose that the external and internal wave functions (objects) form a special product state $\psi_e \psi_i^*$ with $\psi_i^*$ containing the hidden variables, quantum potentials or self-gravity as shown below, *visa versa*.

From the following equations for unspinized free particle in Dirac and Weyl form respectively:

$$\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = L_M \psi_D = 0 \tag{4.1}$$

and

$$\begin{pmatrix} E-|\mathbf{p}| & -m \\ -m & E+|\mathbf{p}| \end{pmatrix}\begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M \psi_W = 0 \tag{4.2}$$

we respectively obtained the following equations in the determinant view (Klein Gordon form):

$$\begin{pmatrix} (DetL_M)\psi_{e,+}\psi^*_{i,-} = (E^2 - m^2 - \mathbf{p}^2)\psi_{e,+}\psi^*_{i,-} = 0 \\ (E^2 - m^2 - \mathbf{p}^2)\psi_{e,+} = 0 \\ (E^2 - m^2 - \mathbf{p}^2)\psi^*_{i,-} = 0 \end{pmatrix} \tag{4.3}$$

and

$$\begin{pmatrix} (DetL_M)\psi_{e,l}\psi^*_{i,r} = (E^2 - \mathbf{p}^2 - m^2)\psi_{e,l}\psi^*_{i,r} = 0 \\ (E^2 - \mathbf{p}^2 - m^2)\psi_{e,l} = 0 \\ (E^2 - \mathbf{p}^2 - m^2)\psi^*_{i,r} = 0 \end{pmatrix} \tag{4.4}$$

By way of an example, equation (4.1) has the following plane-wave solution:

$$\begin{pmatrix} \psi_{e,+} = a_{e,+}e^{-i(Et-\mathbf{p}\cdot\mathbf{x})} \\ \psi_{e,-} = a_{i,-}e^{-i(Et-\mathbf{p}\cdot\mathbf{x})} \end{pmatrix} \tag{4.5}$$

from which we have:

$$\psi_{e,+}\psi^*_{i,-} = \left(a_{e,+}e^{-i(Et-\mathbf{p}\cdot\mathbf{x})}\right)_e \left(a^*_{i,-}e^{+i(Et-\mathbf{p}\cdot\mathbf{x})}\right)_i \tag{4.6}$$

where

$$\begin{pmatrix} (Et - \mathbf{p}\cdot\mathbf{x})_e = \phi_e \\ -(Et - \mathbf{p}\cdot\mathbf{x})_i = \phi_i \end{pmatrix} \tag{4.7}$$

are respectively the external and internal phase in the determinant view. The variables in $\psi^*_{i,-}$ play the roles of hidden variables to $\psi_{e,+}$ which would be annihilated, if $\psi^*_{i,-}$ is allowed to merged with $\psi_{e,+}$. Indeed, if the relativistic mass in external wave function $\psi_{e,+}$ is considered to be inertial mass, then the relativistic mass in the conjugate internal wave function $\psi^*_{i,-}$ plays the role of gravitational mass. We will discuss quantum potential later.

Similarly, from the following equations for spinized free fermion in Dirac and Weyl form respectively:

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix}\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = L_M\psi = 0 \tag{4.8}$$

and

$$\begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p} & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix}\begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M\psi = 0 \tag{4.9}$$

where $\psi_D=(\psi_{e,+}, \psi_{i,-})^T=(\psi_1,\psi_2, \psi_3, \psi_4)^T$ and $\psi_W=(\psi_{e,l}, \psi_{i,r})^T=(\phi_1, \phi_2, \phi_3, \phi_4)^T$, we respectively obtained following equations in the determinant view (Klein Gordon form):

$$\begin{pmatrix} (Det_\sigma L_M)\psi_{e,+}\psi^*_{i,-} = (E^2 - m^2 - \mathbf{p}^2)I_2\psi_{e,+}\psi^*_{i,-} = 0 \\ (E^2 - m^2 - \mathbf{p}^2)\psi_1 = 0 \\ (E^2 - m^2 - \mathbf{p}^2)\psi_2 = 0 \\ (E^2 - m^2 - \mathbf{p}^2)\psi^*_3 = 0 \\ (E^2 - m^2 - \mathbf{p}^2)\psi^*_4 = 0 \end{pmatrix} \tag{4.10}$$

and

$$\begin{pmatrix} (Det_\sigma L_M)\psi_{e,l}\psi^*_{i,r} = (E^2 - \mathbf{p}^2 - m^2)I_2\psi_{e,l}\psi^*_{i,r} = 0 \\ (E^2 - \mathbf{p}^2 - m^2)\phi_1 = 0 \\ (E^2 - \mathbf{p}^2 - m^2)\phi_2 = 0 \\ (E^2 - \mathbf{p}^2 - m^2)\phi^*_3 = 0 \\ (E^2 - \mathbf{p}^2 - m^2)\phi^*_4 = 0 \end{pmatrix} \tag{4.11}$$

In the presence of electromagnetic potential $A^\mu = (\phi, \mathbf{A})$, we have from equations (4.1) and (4.2) the following equations:

$$\begin{pmatrix} E - e\phi - m & -|\mathbf{p}\text{-}e\mathbf{A}| \\ -|\mathbf{p}\text{-}e\mathbf{A}| & E - e\phi + m \end{pmatrix}\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = L_M\psi_D = 0 \tag{4.12}$$

and

$$\begin{pmatrix} E - e\phi - |\mathbf{p}\text{-}e\mathbf{A}| & -m \\ -m & E - e\phi + |\mathbf{p}\text{-}e\mathbf{A}| \end{pmatrix}\begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M\psi_W = 0 \tag{4.13}$$

from which we respectively obtained the following equations in the determinant view (Klein Gordon form):

$$\begin{pmatrix} (DetL_M)\psi_{e,+}\psi^*_{i,-} = ((E - e\phi)^2 - m^2 - (\mathbf{p}\text{-}e\mathbf{A})^2)\psi_{e,+}\psi^*_{i,-} = 0 \\ ((E - e\phi)^2 - m^2 - (\mathbf{p}\text{-}e\mathbf{A})^2)\psi_{e,+} = 0 \\ ((E - e\phi)^2 - m^2 - (\mathbf{p}\text{-}e\mathbf{A})^2)\psi^*_{i,-} = 0 \end{pmatrix} \tag{4.14}$$

and

$$\begin{pmatrix} (DetL_M)\psi_{e,l}\psi^*_{i,r} = ((E - e\phi)^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 - m^2 + \alpha\beta - \beta\alpha)\psi_{e,l}\psi^*_{i,r} = 0 \\ ((E - e\phi)^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 - m^2 + \alpha\beta - \beta\alpha)\psi_{e,l} = 0 \\ ((E - e\phi)^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 - m^2 + \alpha\beta - \beta\alpha)\psi^*_{i,r} = 0 \end{pmatrix} \tag{4.15}$$

where $\alpha = E - e\phi$ and $\beta = |\mathbf{p}\text{-}e\mathbf{A}|$. After spinization of equations (4.12) and (4.13), we have:

$$\begin{pmatrix} E - e\phi - m & -\boldsymbol{\sigma}\cdot(\mathbf{p}\text{-}e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}\text{-}e\mathbf{A}) & E - e\phi + m \end{pmatrix}\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = L_M\psi_D = 0 \tag{4.16}$$

and

$$\begin{pmatrix} E-e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}\text{-}e\mathbf{A}) & -m \\ -m & E-e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}\text{-}e\mathbf{A}) \end{pmatrix}\begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M \psi_W = 0 \tag{4.17}$$

from which we respectively obtained the following equations in the determinant view (Klein Gordon form):

$$\begin{pmatrix} (Det_\sigma L_M)\psi_{e,+}\psi_{i,-}^* = \left((E-e\phi)^2 - m^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 + e\boldsymbol{\sigma}\cdot\mathbf{B}\right)I_2\psi_{e,+}\psi_{i,-}^* = 0 \\ \left((E-e\phi)^2 - m^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 + e\boldsymbol{\sigma}\cdot\mathbf{B}\right)I_2\psi_{e,+} = 0 \\ \left((E-e\phi)^2 - m^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 + e\boldsymbol{\sigma}\cdot\mathbf{B}\right)I_2\psi_{i,-}^* = 0 \end{pmatrix} \tag{4.18}$$

and

$$\begin{pmatrix} (Det_\sigma L_M)\psi_{e,l}\psi_{i,r}^* = \left((E-e\phi)^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 - m^2 + e\sigma\cdot\mathbf{B}\text{-}ie\sigma\cdot\mathbf{E}\right)I_2\psi_{e,l}\psi_{i,r}^* = 0 \\ \left((E-e\phi)^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 - m^2 + e\sigma\cdot\mathbf{B}\text{-}ie\sigma\cdot\mathbf{E}\right)I_2\psi_{e,l} = 0 \\ \left((E-e\phi)^2 - (\mathbf{p}\text{-}e\mathbf{A})^2 - m^2 + e\sigma\cdot\mathbf{B}\text{-}ie\sigma\cdot\mathbf{E}\right)I_2\psi_{i,r}^* = 0 \end{pmatrix} \tag{4.19}$$

In equations (4.16) and (4.17), the couplings of **E** and/or **B** with spin **σ** are implicit or hidden. These interactions are due to self-referential Matrix Law $L_M$ which causes mixing of the external and internal wave functions. However, in the determinant view, these interactions are made explicit as shown in equations (4.18) and (4.19) respectively.

### 4.3. The Meaning of Schrodinger Equation & Quantum Potential

It can be shown that the following Schrodinger Equation is the non-relativistic approximation of equation (4.3) or (4.4):

$$i\partial_t\psi = H\psi = -\frac{1}{2m}\nabla^2\psi \tag{4.20}$$

where $\psi = \psi_{\mathrm{Re}} + i\,\psi_{\mathrm{Im}}$. Equation (4.20) can be written as two coupled equations:

$$\begin{pmatrix} \partial_t\psi_{\mathrm{Re}} = H\psi_{\mathrm{Im}} \\ \partial_t\psi_{\mathrm{Im}} = -H\psi_{\mathrm{Re}} \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} \partial_t & -H \\ H & \partial_t \end{pmatrix}\begin{pmatrix} \psi_{\mathrm{Re}} \\ \psi_{\mathrm{Im}} \end{pmatrix} = 0 \tag{4.21}$$

The above equation describes the non-relativistic self-reference of the wave components $\psi_{\mathrm{Re}}$ and $\psi_{\mathrm{Im}}$ due to spin *i*. If we designate $\psi_{\mathrm{Re}}$ as external object, $\psi_{\mathrm{Im}}$ is the internal object. It is the non-relativistic approximation of the determinant view of an unspinized particle (Klein-Gordon form) with self-referential interaction reduced to spin *i* and contained in the wave function from which the quantum potential $Q$ can be extracted.

For example, in the case:

$$\psi_{e,+}\psi_{i,-}^* = a_{e,+}e^{-i(Et-\mathbf{p}\cdot\mathbf{x})}a_{i,-}e^{+i(Et-\mathbf{p}\cdot\mathbf{x})} \approx \psi = \rho e^{-iS}e^{+i\zeta} \tag{4.22}$$

where $a_{e,+}$ and $a_{i,-}$ are real, ζ contains the hidden variables and:

$$\begin{pmatrix} \rho = a_{e,+}a_{i,-} \\ S = \left(E_p t - \mathbf{p}\cdot\mathbf{x}\right)_e \\ \zeta = \left(E_p t - \mathbf{p}\cdot\mathbf{x}\right)_i \\ E_p = \dfrac{\mathbf{p}^2}{2m} \end{pmatrix} \tag{4.23}$$

we can derive the following quantum potential (details will be given elsewhere):

$$Q = -\frac{1}{2m}(\nabla\zeta)^2 = \left(-\frac{\mathbf{p}^2}{2m}\right)_i = \left(-E_p\right)_i \tag{4.24}$$

which originates from spin *i* in:

$$\psi_{i,-}^* = a_{i,-}e^{i(Et-\mathbf{p}\cdot\mathbf{x})} \approx a_{i,-}e^{+imt}e^{+i\zeta} \tag{4.25}$$

$Q$ would negate the non-relativistic kinetic energy of the external wave function if the external wave function and the conjugate internal wave function would merge.

Further, it can be shown that the Pauli Equation is the non-relativistic approximation of equation (4.18) which is the determinant view of a fermion in an electromagnetic field in Dirac form:

$$i\partial_t\begin{pmatrix}\varphi_1\\ \varphi_2\end{pmatrix} = \left(\frac{1}{2m}\left(-i\nabla - e\mathbf{A}\right)^2 - \frac{e}{2m}\boldsymbol{\sigma}\cdot\mathbf{B} + e\phi\right)\begin{pmatrix}\varphi_1\\ \varphi_2\end{pmatrix} \tag{4.24}$$

It contain non-relativistic self-reference due to both spin *i* and $\boldsymbol{\sigma}$ and will be treated elsewhere in detail when and if time permits.

## 4.4 The Third State of Matter

Traditionally, a scalar (spinless) particle is presumed to be described by the Klein-Gordon equation and is classified as a boson. However, in this work we have suggested that Kein-Gordon equation is a determinant view of a fermion, boson or an unspinized entity (spinlesson) in which the external and internal wave functions (objects) form a special product state $\psi_e\psi_i^*$ with $\psi_i^*$ as the origin of hidden variable, quantum potentials or self-gravity. The unspinized entity (spinlesson) is neither a boson nor a fermion but may be classified as a third state of matter described by the unspinized equation in Dirac or Weyl (chiral) form, for example:

$$\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} a_{e,+}e^{-ip^\mu x_\mu} \\ a_{i,-}e^{-ip^\mu x_\mu} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix}\psi_{e,+}\\ \psi_{i,-}\end{pmatrix} = L_M\psi = 0 \tag{4.25}$$

$$\begin{pmatrix} E-|\mathbf{p}| & -m \\ -m & E+|\mathbf{p}| \end{pmatrix} \begin{pmatrix} a_{e,l}e^{-ip^{\mu}x_{\mu}} \\ a_{i,r}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M \psi = 0 \tag{4.26}$$

The hadronized versions of the above equations in which the momentum is imaginary are respectively as follows:

$$\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix} \begin{pmatrix} s_{e,+}e^{-iEt} \\ s_{i,-}e^{-iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = L_M \psi = 0 \tag{4.27}$$

$$\begin{pmatrix} E-|\mathbf{p}_i| & -m \\ -m & E+|\mathbf{p}_i| \end{pmatrix} \begin{pmatrix} s_{e,l}e^{-iEt} \\ s_{i,r}e^{-iEt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = L_M \psi = 0 \tag{4.28}$$

The third state of matter may not subject to the statistical behavior of either bosons or fermions. The wave functions of a fermion and boson are respectively a bispinor and bi-vector but that of the third state (spinlesson) is two-component complex scalar field. The third state of matter is the precursor of both fermionic and bosonic matters/fields before fermionic or bosonic spinization. Thus, we suggest that it steps into the shoes played by the Higgs field in the standard model which so far has not been found. Further, in this scenario, mass is created by GOD's self-referential spin (imagination).

## 5. WEAK INTERACTION

Weak interaction is an expressive process (emission or radiation) through fermionic spinization with or without intermediary bosonic spinization and the associated reverse process (capture or absorption). There are possibly two kinds of mechanisms at play. One kind is the direct fermionic spinization of an unspinized massive particle as shown in § 3:

$$|\mathbf{p}| = \sqrt{\mathbf{p^2}} = \sqrt{-Det(\boldsymbol{\sigma}\cdot\mathbf{p})} \rightarrow \boldsymbol{\sigma}\cdot\mathbf{p} \tag{5.1}$$

that is, for example:

$$\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \rightarrow \begin{pmatrix} E-m & -\sigma\cdot\mathbf{p} \\ -\sigma.\mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \tag{5.2}$$

and the following reverse process:

$$\boldsymbol{\sigma}\cdot\mathbf{p} \rightarrow \sqrt{-Det(\boldsymbol{\sigma}\cdot\mathbf{p})} = \sqrt{\mathbf{p^2}} = |\mathbf{p}| \tag{5.3}$$

that is, for example:

$$\begin{pmatrix} E-m & -\sigma\cdot\mathbf{p} \\ -\sigma.\mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \rightarrow \begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \tag{5.4}$$

Processes (5.1) and (5.3) only conserve spin in the dual world as a whole. If they hold in reality, neutrino may not be needed in the weak interaction as currently understood or assumed.

Accordingly, beta decay of neutron may involve the spinizing process (5.1) during which an unspinized proton (or electron) gains its spin 1/2 and bound spinized electron becomes free as follows:

(1) Spinless Proton → Spinized Proton → Release of Bound Electron; or

(2) Spinless Electron → Spinized Electron → Release of Spinized Electron.

Process (1) seems in closer agreement with experimental data on *g*-factor and charge density of neutron. There is no exchange particle involved in process (1) or (2). In neutron synthesis from proton and electron, if exists, the reverse process (5.3) occurs during which a spinized proton (or electron) loses its spin and free electron becomes tightly bound to proton.

We suggest that the following equation governs free unspinized particles having mass $m$ and electric charge $e$ respectively but spinless, that is, they are pion-like particle or pion particles $\pi^{\pm}$ themselves (their combination generates $\pi^0$):

$$\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix}=0 \quad \text{or} \quad \begin{pmatrix} (E-m)\psi_e = |\mathbf{p}|\psi_i \\ (E+m)\psi_i = |\mathbf{p}|\psi_e \end{pmatrix} \tag{5.5}$$

After spinization through (5.1), we arrive at Dirac equation:

$$\begin{pmatrix} E-m & -\sigma\cdot\mathbf{p} \\ -\sigma\cdot\mathbf{p} & E+m \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix}=0 \quad \text{or} \quad \begin{pmatrix} (E-m)\psi_e = \boldsymbol{\sigma}\cdot\mathbf{p}\psi_i \\ (E+m)\psi_i = \boldsymbol{\sigma}\cdot\mathbf{p}\psi_e \end{pmatrix} \tag{5.6}$$

Assuming a plane wave $\psi_{e,+} = e^{-ip^{\mu}x_{\mu}}$ exists for equation (5.5), we obtain the following solution for the said equation ($\pi^-$-like plane-wave solution):

$$\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = \sqrt{\frac{E+m}{2E}}\begin{pmatrix} e^{-ip^{\mu}x_{\mu}} \\ \frac{|\mathbf{p}|}{E+m}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = N\begin{pmatrix} 1 \\ \frac{|\mathbf{p}|}{E+m} \end{pmatrix}e^{-ip^{\mu}x_{\mu}} \tag{5.7}$$

where N is a normalization factor and we have utilized the following relation for an energy eigenstate:

$$(E+m)\psi_{i,-} = |\mathbf{p}|\psi_{e,+} \rightarrow \psi_{i,-} = \frac{|\mathbf{p}|}{E+m}\psi_{e,+} \tag{5.8}$$

After spinization of solution (5.7):

$$\begin{pmatrix} 1 \\ \dfrac{|\mathbf{p}|}{E+m} \end{pmatrix} \to \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ \multicolumn{2}{c}{\dfrac{\boldsymbol{\sigma}\cdot\mathbf{p}}{E+m}} \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \\ \dfrac{p_z}{E+m} & \dfrac{p_x - ip_y}{E+m} \\ \dfrac{p_x + ip_y}{E+m} & \dfrac{-p_z}{E+m} \end{pmatrix} \tag{5.9}$$

we arrive at the free plane-wave electron solution for Dirac equation (5.6):

$$\begin{pmatrix} \psi_{e,+}^{\uparrow} \\ \psi_{i,-} \end{pmatrix} = \sqrt{\frac{E+m}{2E}} \begin{pmatrix} 1 \\ 0 \\ \dfrac{p_z}{E+m} \\ \dfrac{p_x+ip_y}{E+m} \end{pmatrix} e^{-ip^\mu x_\mu} \quad \text{and} \quad \begin{pmatrix} \psi_{e,+}^{\downarrow} \\ \psi_{i,-} \end{pmatrix} = \sqrt{\frac{E+m}{2E}} \begin{pmatrix} 0 \\ 1 \\ \dfrac{p_x-ip_y}{E+m} \\ \dfrac{-p_z}{E+m} \end{pmatrix} e^{-ip^\mu x_\mu} \tag{5.10}$$

In the above solutions for external spin up and down respectively, the external spin 1/2 is balanced by the internal spin components which may be deemed as antineutrino such that the total spin in the dual world is still conserved to zero. Therefore, it seems that external spin up or down can be created without the need of a separate antineutrino in beta decay, if any excessive energy $\Delta E$ and or momentum $\Delta \boldsymbol{p}$ are allowed to cancel each other in Godhead:

$$\begin{pmatrix} e^{-i(\Delta Et - \Delta\mathbf{p}\cdot\mathbf{x})} \\ e^{-i(\Delta Et - \Delta\mathbf{p}\cdot\mathbf{x})} \end{pmatrix} \to e^{-i(\Delta Et - \Delta\mathbf{p}\cdot\mathbf{x})} e^{+i(\Delta Et - \Delta\mathbf{p}\cdot\mathbf{x})t} = e^{-i(\Delta Et - \Delta\mathbf{p}\cdot\mathbf{x}) + i(\Delta Et - \Delta\mathbf{p}\cdot\mathbf{x})} = e^0 = 1 \tag{5.11}$$

Further, if GOD allows the following bosonic spinization of massive spinless particle (e.g., as unstable particle with very short life-time):

$$|\mathbf{p}| = \sqrt{\mathbf{p^2}} = \sqrt{-(Det(\mathbf{s}\cdot\mathbf{p} + I_3) - Det(I_3))} \leftrightarrow \mathbf{s}\cdot\mathbf{p} \tag{5.12}$$

that is, for example:

$$\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \leftrightarrow \begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \tag{5.13}$$

and/or

$$|\mathbf{p}| = \sqrt{\mathbf{p^2}} = \sqrt{-(Det(\mathbf{s}\cdot\mathbf{p} + I_3) - Det(I_3))} \to \mathbf{s}\cdot\mathbf{p} \to (\boldsymbol{\sigma}\cdot\mathbf{p})_1 + (\boldsymbol{\sigma}\cdot\mathbf{p})_2 \tag{5.14}$$

that is, for example:

$$\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \to \begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \tag{5.15}$$

$$\rightarrow\left(\begin{pmatrix} E-m & -\sigma\cdot\mathbf{p} \\ -\sigma\cdot\mathbf{p} & E+m \end{pmatrix}\begin{pmatrix}\psi_e \\ \psi_i\end{pmatrix}=0\right)_1\left(\begin{pmatrix} E & -\sigma\cdot\mathbf{p} \\ -\sigma\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix}\psi_e \\ \psi_i\end{pmatrix}=0\right)_2$$

during which transitory states known as vector bosons $W^-$, $W^+$ and/or $Z^0$ appear and disappear, we have from expression (5.14) the second kind of weak interactions. We point out here that only process (5.14) mediates weak interactions since in process (5.12) vector bosons $W^-$, $W^+$ and/or $Z^0$ are just transitory states which do not decay into fermions.

The spinized equation in expression (5.13) for a free massive spin 1 particle may take the following Dirac form:

$$\begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E+m \end{pmatrix}\begin{pmatrix}\psi_{e,+} \\ \psi_{i,-}\end{pmatrix}=L_M\begin{pmatrix}\psi_{e,+} \\ \psi_{i,-}\end{pmatrix}=L_M\begin{pmatrix}\mathbf{E} \\ i\mathbf{B}\end{pmatrix}=L_M\psi=0 \qquad (5.16)$$

or

$$\begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E+m \end{pmatrix}\begin{pmatrix}\psi_{e,-} \\ \psi_{i,+}\end{pmatrix}=L_M\begin{pmatrix}\psi_{e,-} \\ \psi_{i,+}\end{pmatrix}=L_M\begin{pmatrix}i\mathbf{B} \\ \mathbf{E}\end{pmatrix}=L_M\psi=0 \qquad (5.17)$$

After calculating the determinant:

$$Det_s\begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E+m \end{pmatrix}=(E-m)(E+m)-(-\mathbf{s}\cdot\mathbf{p})(-\mathbf{s}\cdot\mathbf{p}) \qquad (5.18)$$

We obtain the following:

$$Det_s\begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E+m \end{pmatrix}=\left(E^2-\mathbf{p}^2-m^2\right)I_3-\begin{pmatrix} p_x^2 & p_xp_y & p_xp_z \\ p_yp_x & p_y^2 & p_yp_z \\ p_zp_x & p_zp_y & p_z^2 \end{pmatrix} \qquad (5.19)$$

$$=\left(E^2-\mathbf{p}^2-m^2\right)I_3-M_T$$

As mentioned in § 3, the last term $M_T$ in expression (5.19) makes fundamental relationship $E^2-\mathbf{p}^2-m^2=0$ not to hold in the determinant view (5.18) unless the action of $M_T$ on the external and internal components of the wave function produces null result, that is:

$$M_T\begin{pmatrix}E_x \\ E_y \\ E_z\end{pmatrix}=(p_x+p_y+p_z)\mathbf{P}\cdot\mathbf{E}=\mathbf{0} \qquad (5.20)$$

and

$$M_T \begin{pmatrix} B_x \\ B_y \\ B_z \end{pmatrix} = (p_x + p_y + p_z)\mathbf{P}\cdot\mathbf{B} = \mathbf{0} \tag{5.21}$$

Thus, if GOD allows these violations to exist transitorily, equations (5.16) and (5.17) may describe free vector bosons $W^-$ and $W^+$ respectively, their combination then describe free vector boson $Z^0$, and $M_T$ may be deemed as transitory mass (or mass operator).

In contrast to process (1) and (2), vector bosons $W^-$ and $W^+$ or the like respectively mediate the spinization of spinless proton or electron respectively as follows:

(3) Spinless Proton → Spinized Vector Boson $W^+$ → Spinized Proton + Spinized 2nd Fermion → Release of Bound Electron + Spinized 2nd Fermion; and

(4) Spinless Electron → Spinized Vector Boson $W^-$ → Spinized Electron + Spinized 2nd Fermion → Release of Spinized Electron + Spinized 2nd Fermion.

It is hoped that the metamorphous forms of Matrix Law in § 3, their further metamorphoses and the corresponding wave functions that these laws govern will be able to accommodate all known particles in the particle zoo.

Very importantly, there maybe no parity violations in weak interactions such as beta decay as the apparent parity violation in the experiment may simply be explained as a spin polarization effect in which the spin polarization influences the dynamics and directions of the emitted electron in an external magnetic field. Also, there may be no need for Higgs boson for generating mass since mass is generated by self-referential spin within Godhead, so the GOD particle is simply $1=\mathbf{e}^0=\mathbf{e}^{\mathbf{i}M-\mathbf{i}M}$ ….

## 6. ELECTROMAGNETIC INTERACTION

Electromagnetic interaction is expressive process (radiation or emission) through bosonic spinization of a massless and spinless entity and the associated reverse process (absorption). There are possibly two kinds of mechanisms at play. One kind is the direct bosonic spinization (spinizing radiation):

$$|\mathbf{p}| = \sqrt{\mathbf{p^2}} = \sqrt{-\left(Det(\mathbf{s}\cdot\mathbf{p}+I_3)-Det(I_3)\right)} \rightarrow \mathbf{s}\cdot\mathbf{p} \tag{6.1}$$

that is, for example:

$$\begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \rightarrow \begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}.\mathbf{p} & E \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \tag{6.2}$$

and the following reverse process (unspinizing absorption):

$$\mathbf{s}\cdot\mathbf{p} \to \sqrt{-\left(Det(\mathbf{s}\cdot\mathbf{p}+I_3)-Det(I_3)\right)} = \sqrt{\mathbf{p}^2} = |\mathbf{p}| \tag{6.3}$$

that is, for example:

$$\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s.p} & E \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \to \begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \tag{6.4}$$

The radiation or absorption of a photon during acceleration of a charge particle may be direct bosonic spinizing or unspinizing process respectively:

(1) Bound Spinless & Massless Particle → Bound Spinized Photon → Free Spinized Photon; and

(2) Free Spinized Photon → Bound Spinized Photon → Bound Spinless & Massless Particle.

These two processes may also occur in nuclear decay and perhaps other processes. Assuming a plane wave $\psi_{e,+} = e^{-ip^{\mu}x_{\mu}}$ exists for the spinless and massless particle:

$$\begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0 \quad \text{or} \quad \begin{pmatrix} E\psi_e = |\mathbf{p}|\psi_i \\ E\psi_i = |\mathbf{p}|\psi_e \end{pmatrix} \tag{6.5}$$

we obtain the following solution for this equation:

$$\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = \sqrt{\frac{1}{2}}\begin{pmatrix} e^{-ip^{\mu}x_{\mu}} \\ \frac{|\mathbf{p}|}{E}e^{-ip^{\mu}x_{\mu}} \end{pmatrix} = N\begin{pmatrix} 1 \\ \frac{|\mathbf{p}|}{E} \end{pmatrix}e^{-ip^{\mu}x_{\mu}} \tag{6.6}$$

where we have utilized the following relation for an energy eigenstate and N is the normalization factor :

$$E\psi_{i,-} = |\mathbf{p}|\psi_{e,+} \to \psi_{i,-} = \frac{|\mathbf{p}|}{E}\psi_{e,+} \tag{6.7}$$

After spinization:

$$\frac{|\mathbf{p}|}{E} \to \frac{\mathbf{s}\cdot\mathbf{p}}{E} = \begin{pmatrix} 0 & \frac{-ip_z}{E} & \frac{ip_y}{E} \\ \frac{ip_z}{E} & 0 & -\frac{ip_x}{E} \\ -\frac{ip_y}{E} & \frac{ip_x}{E} & 0 \end{pmatrix} \tag{6.8}$$

We arrive at the plane-wave solution:

$$\begin{pmatrix}\psi_{e,+}^{x}\\ \psi_{i,-}\end{pmatrix}=\sqrt{\frac{1}{2}}\begin{pmatrix}1\\0\\0\\0\\ \frac{ip_z}{E}\\ \frac{-ip_y}{E}\end{pmatrix}e^{-ip^{\mu}x_{\mu}}\quad \begin{pmatrix}\psi_{e,+}^{y}\\ \psi_{i,-}\end{pmatrix}=\sqrt{\frac{1}{2}}\begin{pmatrix}0\\1\\0\\ \frac{-ip_z}{E}\\0\\ \frac{ip_x}{E}\end{pmatrix}e^{-ip^{\mu}x_{\mu}}\quad \begin{pmatrix}\psi_{e,+}^{z}\\ \psi_{i,-}\end{pmatrix}=\sqrt{\frac{1}{2}}\begin{pmatrix}0\\0\\1\\ \frac{ip_y}{E}\\ \frac{-ip_x}{E}\\0\end{pmatrix}e^{-ip^{\mu}x_{\mu}} \tag{6.9}$$

for the spinized photon equation:

$$\begin{pmatrix}E & -\mathbf{s}\cdot\mathbf{p}\\ -\mathbf{s}\cdot\mathbf{p} & E\end{pmatrix}\begin{pmatrix}\psi_e\\ \psi_i\end{pmatrix}=0 \quad \text{or} \quad \begin{pmatrix}E\psi_e=\mathbf{s}\cdot\mathbf{p}\psi_i\\ E\psi_i=\mathbf{s}\cdot\mathbf{p}\psi_e\end{pmatrix} \tag{6.10}$$

Second kind of electromagnetic interactions is the release (radiation) or binding (absorption) of a spinized photon without unspinization:

(3) Bound Spinized Photon → Free Spinized Photon; and

(4) Free Spinized Photon → Bound Spinized Photon.

Processes (3) and (4) occur at the openings of an optical cavity or waveguide and may also occur in atomic photon excitation and emission and perhaps other processes.

For bosonic spinization $|\mathbf{p}|=\sqrt{\mathbf{p}^2}\rightarrow\mathbf{s}\cdot\mathbf{p}$, the Maxwell equations in the vacuum (c=1; $\varepsilon_0$=1) are as follows:

$$\begin{pmatrix}\begin{pmatrix}E & -\mathbf{s}\cdot\mathbf{p}\\ -\mathbf{s}\cdot\mathbf{p} & E\end{pmatrix}\begin{pmatrix}\mathbf{E}\\ i\mathbf{B}\end{pmatrix}=0\\ \mathbf{p}\cdot\mathbf{E}=0\\ \mathbf{p}\cdot\mathbf{B}=0\end{pmatrix},\quad \begin{pmatrix}\begin{pmatrix}\partial_t & -\nabla\times\\ \nabla\times & \partial_t\end{pmatrix}\begin{pmatrix}\mathbf{E}\\ \mathbf{B}\end{pmatrix}=0\\ \nabla\cdot\mathbf{E}=0\\ \nabla\cdot\mathbf{B}=0\end{pmatrix}\quad \text{or}\quad \begin{pmatrix}\partial_t\mathbf{E}=\nabla\times\mathbf{B}\\ \partial_t\mathbf{B}=-\nabla\times\mathbf{E}\\ \nabla\cdot\mathbf{E}=0\\ \nabla\cdot\mathbf{B}=0\end{pmatrix} \tag{6.11}$$

If we calculate the determinant:

$$Det_s\begin{pmatrix}E & -\mathbf{s}\cdot\mathbf{p}\\ -\mathbf{s}\cdot\mathbf{p} & E\end{pmatrix}=E\cdot E-(-\mathbf{s}\cdot\mathbf{p})(-\mathbf{s}\cdot\mathbf{p}) \tag{6.12}$$

We obtain the following:

$$Det_s\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} = \left(E^2-\mathbf{p}^2\right)I_3 - \begin{pmatrix} p_x^2 & p_x p_y & p_x p_z \\ p_y p_x & p_y^2 & p_y p_z \\ p_z p_x & p_z p_y & p_z^2 \end{pmatrix} = \left(E^2-\mathbf{p}^2\right)I_3 - M_T \tag{6.13}$$

The last term $M_T$ in expression (6.13) makes fundamental relationship $E^2-\mathbf{p}^2=0$ not to hold in the determinant view (6.12) unless the action of $M_T$ on the external and internal components of the wave function produces null result, since equations (5.20) and (5.21) only hold in the source-free region.

At the location of a massive charged particle such as electron or proton, equations (5.20) and (5.21) are also violated by the photon. That is, the photon appears to have mass $M_T$ at the source thus particle pairs may be created on collision of a photon with a massive charged particle. In the Maxwell equations, these violations are counter-balanced by adding source to the equations as discussed below. The Maxwell equations with source are, in turn, coupled to the Dirac Equation of the fermions such as electron or proton forming the Dirac-Maxwell system as further discussed in § 11. Indeed, if source $j^\mu=(\rho,\mathbf{j})\neq 0$, we have instead:

$$\begin{pmatrix} \begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix} \mathbf{E} \\ i\mathbf{B} \end{pmatrix} = \begin{pmatrix} -i\mathbf{j} \\ 0 \end{pmatrix} \\ \mathbf{p}\cdot\mathbf{E} = -i\rho \\ \mathbf{p}\cdot\mathbf{B} = 0 \end{pmatrix}, \quad \begin{pmatrix} \begin{pmatrix} \partial_t & -\nabla\times \\ \nabla\times & \partial_t \end{pmatrix}\begin{pmatrix} \mathbf{E} \\ \mathbf{B} \end{pmatrix} = \begin{pmatrix} -\mathbf{j} \\ 0 \end{pmatrix} \\ \nabla\cdot\mathbf{E} = \rho \\ \nabla\cdot\mathbf{B} = 0 \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} \partial_t\mathbf{E} = \nabla\times\mathbf{B} - \mathbf{j} \\ \partial_t\mathbf{B} = -\nabla\times\mathbf{E} \\ \nabla\cdot\mathbf{E} = \rho \\ \nabla\cdot\mathbf{B} = 0 \end{pmatrix} \tag{6.14}$$

Importantly, we can also choose to use fermionic spinization scheme $|\mathbf{p}|=\sqrt{\mathbf{p^2}} \longrightarrow \boldsymbol{\sigma}\cdot\mathbf{p}$ to describe Maxwell equations. In this case, the Maxwell equation in the vacuum has the form:

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix} \boldsymbol{\sigma}\cdot\mathbf{E} \\ i\boldsymbol{\sigma}\cdot\mathbf{B} \end{pmatrix} = 0 \tag{6.15}$$

which gives:

$$\begin{pmatrix} \partial_t\mathbf{E} = \nabla\times\mathbf{B} \\ \partial_t\mathbf{B} = -\nabla\times\mathbf{E} \\ \nabla\cdot\mathbf{E} = 0 \\ \nabla\cdot\mathbf{B} = 0 \end{pmatrix} \tag{6.16}$$

If source $j^\mu=(\rho,\mathbf{j})\neq 0$, we have:

$$\begin{pmatrix} E & \mathbf{-\sigma\cdot p} \\ \mathbf{-\sigma\cdot p} & E \end{pmatrix}\begin{pmatrix} \boldsymbol{\sigma}\cdot\mathbf{E} \\ i\boldsymbol{\sigma}\cdot\mathbf{B} \end{pmatrix}=\begin{pmatrix} -i\boldsymbol{\sigma}\cdot\mathbf{j} \\ -i\rho \end{pmatrix} \tag{6.17}$$

which gives:

$$\begin{pmatrix} \partial_t\mathbf{E}=\nabla\times\mathbf{B}-\mathbf{j} \\ \partial_t\mathbf{B}=-\nabla\times\mathbf{E} \\ \nabla\cdot\mathbf{E}=\rho \\ \nabla\cdot\mathbf{B}=0 \end{pmatrix} \tag{6.18}$$

Therefore, in the fermionic spinization scheme, we have in the place of bi-vector wave function a 4x4 tensor comprising of two bi-spinors (instead of bi-vector itself) generated by projecting the bi-vector comprised of **E** and ***i*B** to spin ***σ***.

Further, we point out here that for a linear photon its electric field **E** is the external wave function (external object) and its magnetic field **B** is the internal wave function (internal object). These two fields are always self-entangled and their entanglement is their self-gravity. Therefore, the relation between **E** and **B** in a propagating electromagnetic wave is not that change in **E** induces **B** *visa versa* but change in **E** are always accompanied by change in **B** *visa versa* due to their entanglement (self-gravity). That is, the relationship between **E** and **B** are gravitational and instantaneous.

## 7. STRONG INTERACTION

While weak and electromagnetic interactions are expressive processes involving fermionic and bosonic spinizations of spinless entities (the third state of matter) and their respective reverse processes, strong interaction does not involve spinization, that is, strong force is a confining process. It may be assumed that spinless entities in general are unstable and decay through fermionic or bosonic spinization. In order to achieve confinement of a nucleon or stability of the nucleus, we suggest that strong interaction involve imaginary momentum in the confinement zone as illustrated below. There are two types of strong interaction at play. One is the self-confinement of a nucleon such as a proton and the other is the interaction among nucleons such a proton and a neutron.

In the Standard Model, proton is a composite entity comprised of three quarks confined by massless gluons and the interaction among the nucleons is mediated by mesons comprised of pairs of a quark and an antiquark which in turn interact through gluons. However, since no free quark has been observed, there is good reason to consider other options. We have suggested in § 3 that proton may be considered as an elementary particle which accomplishes spatial self-confinement through downward self-reference (imaginary momentum).

Here, we will first derive the condition for producing spatial self-confinement of the nucleon and the nuclear potential known as the Yukawa potential. The equation for a massive but spinless entity in Dirac Form is as follows:

$$\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix}=0 \quad \text{or} \quad \begin{pmatrix} (E-m)\psi_e = |\mathbf{p}|\psi_i \\ (E+m)\psi_i = |\mathbf{p}|\psi_e \end{pmatrix} \tag{7.1}$$

Assuming that the wave function has energy eigenstate -*E* (that is, the external and internal wave functions respectively have energy eigenstate -*E* and +*E* in the determinant view), we can write:

$$(E-m)\psi_e = |\mathbf{p}|\psi_i \rightarrow (E-m)e^{+iEt}\phi_e(\mathbf{r}) = |\mathbf{p}|e^{+iEt}\phi_i(\mathbf{r}) \rightarrow (-E-m)\phi_e(\mathbf{r}) = |\mathbf{p}|\phi_i(\mathbf{r}) \tag{7.2}$$

$$(E+m)\psi_i = |\mathbf{p}|\psi_e \rightarrow (E+m)e^{+iEt}\phi_i(\mathbf{r}) = |\mathbf{p}|e^{+iEt}\phi_e(\mathbf{r}) \rightarrow \phi_i(\mathbf{r}) = \frac{|\mathbf{p}|}{-E+m}\phi_e(\mathbf{r}) \tag{7.3}$$

From expressions (7.2) and (7.3), we can derive the following:

$$\left(E^2 - m^2 - \mathbf{p}^2\right)\phi_i(\mathbf{r}) = 0 \quad \text{or} \quad \left(E^2 - m^2 + \nabla^2\right)\phi_i(\mathbf{r}) = 0 \tag{7.4}$$

Equation (7.4) has radial solution as follows:

$$\phi_i(r) = \frac{1}{4\pi r}e^{-ir\sqrt{E^2-m^2}} \tag{7.5}$$

Then, we have from expression (7.3):

$$\phi_e(r) = \frac{|\mathbf{p}|}{-E-m}\phi_i(r) = \frac{-|\mathbf{p}|}{E+m}\frac{1}{4\pi r}e^{-ir\sqrt{E^2-m^2}} \rightarrow \frac{-\sqrt{E^2-m^2}}{E+m}\frac{1}{4\pi r}e^{-ir\sqrt{E^2-m^2}} \tag{7.6}$$

where we have utilized the following (for reason to be discussed elsewhere):

$$|\mathbf{p}|\phi_i(r) = \sqrt{-\nabla^2}\,\frac{1}{4\pi r}e^{-ir\sqrt{E^2-m^2}} \rightarrow \sqrt{E^2-m^2}\,\frac{1}{4\pi r}e^{-ir\sqrt{E^2-m^2}} \tag{7.7}$$

The complete radial solution of equation (7.1) for energy eigenstate -*E* in Dirac form is:

$$\psi(t,r) = \begin{pmatrix} \psi_{e,-}(t,r) \\ \psi_{i,+}(t,r) \end{pmatrix} = N\begin{pmatrix} \frac{-\sqrt{E^2-m^2}}{E+m}\frac{1}{4\pi r}e^{+iEt-ir\sqrt{E^2-m^2}} \\ \frac{1}{4\pi r}e^{+iEt-ir\sqrt{E^2-m^2}} \end{pmatrix} = N\begin{pmatrix} -\sqrt{\frac{E-m}{E+m}} \\ 1 \end{pmatrix}\frac{1}{4\pi r}e^{+iEt-ir\sqrt{E^2-m^2}} \tag{7.8}$$

where N is a normalization factor.

When $m^2>E^2$, that is, when the momentum in $E^2-m^2=\boldsymbol{p}^2$ is imaginary, we have from (7.8):

$$\psi(t,r) = \begin{pmatrix} \psi_{e,-}(t,r) \\ \psi_{i,+}(t,r) \end{pmatrix} = N\begin{pmatrix} \frac{-i\sqrt{m^2-E^2}}{E+m}\frac{1}{4\pi r}e^{+iEt-r\sqrt{m^2-E^2}} \\ \frac{1}{4\pi r}e^{+iEt-r\sqrt{m^2-E^2}} \end{pmatrix} = N\begin{pmatrix} -i\beta \\ 1 \end{pmatrix}\frac{1}{4\pi r}e^{+iEt-r\alpha} \tag{7.9}$$

where $\alpha = \sqrt{m^2 - E^2}$ and $\beta = \sqrt{(m-E)(E+m)^{-1}}$. Now, if we consider the special case of a timeless, spinless but massive entity in which $E=0$, that is, the rest mass is all comprised of imaginary momentum $\mathbf{p}_i$, we have from (7.9):

$$\psi(r) = \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = N \begin{pmatrix} \frac{-i}{4\pi r} e^{-rm} \\ \frac{1}{4\pi r} e^{-rm} \end{pmatrix} = N \begin{pmatrix} -i \\ 1 \end{pmatrix} \frac{1}{4\pi r} e^{-rm} \qquad (7.10)$$

Thus, the internal and external wave functions in expression (7.10) respectively have the form of Yukawa potential and its negative imaginary projection.

We propose that the interior (confinement zone) of an unspinized nucleon is described by wave functions similar to expressions (7.9) or (7.10) and confinement is achieved through downward self-reference (imaginary momentum $\mathbf{p}_i$). Therefore, in this scenario, the three colors of the strong force are the three-dimensional imaginary momentum $\mathbf{p}_i$. Further, another implication of this scenario is that in the Machian quantum universe the timeless edge or outside of this universe (which is embedded in prespacetime) is connected to or simply is the timeless inside of the nucleons.

If we assume that the internal wave function $\psi_i$ (which is self-coupled to the external wave function $\psi_e$ through expression (7.1)) also couples with the external wave function $\chi_e$ of another entity (which is also self-coupled to its internal wave function $\chi_i$) as, for example:

$$-g^2 \psi_i \chi_e = -g^2 \frac{1}{4\pi r} e^{-mr} \chi_e = -\frac{g^2}{r} e^{-mr} \chi_e \qquad (7.11)$$

where $-g^2$ is a coupling constant, we can write part of the nuclear potential of a nucleon as follows:

$$V = -\frac{g^2}{r} e^{-mr} \qquad (7.12)$$

which is in the form of Yukawa Potential. We should point out here that in this work we shall not try to develop a full Hamiltonian for two interacting nucleons.

We now discuss the unspinized and spinized forms of proton. The spinized proton is the commonly known form of proton and we suggest that the unspinized proton may reside in the neutron comprised of the unspinized proton and a spinized electron as illustrated in § 3. The equations for a free unspinized and spinized proton in Dirac Form are respectively as follows:

$$\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix}=0 \tag{7.13}$$

and

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i \\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & E+m \end{pmatrix}\begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix}=0 \tag{7.14}$$

where $\mathbf{p}_i$ is imaginary momentum. From the above derivation, we may write the wave function of an unspinized proton with external and internal energy eigenstate -*E* and +*E* respectively as follows (by convention, electron has positive external energy +*E* and internal energy –*E*):

$$\psi(t,r)=\begin{pmatrix} \psi_{e,-}(t,r) \\ \psi_{i,+}(t,r) \end{pmatrix}=N\begin{pmatrix} \dfrac{-|\mathbf{p}_i|}{E+m}\dfrac{1}{4\pi r}e^{+iEt-r\alpha} \\ \dfrac{1}{4\pi r}e^{+iEt-r\alpha} \end{pmatrix}=N\begin{pmatrix} -i\beta \\ 1 \end{pmatrix}e^{+iEt}\frac{1}{4\pi r}e^{-r\alpha} \tag{7.15}$$

In contrast, an unspinized antiproton with external and internal energy eigenstate +*E* and -*E* respectively may have the following wave function:

$$\psi(t,r)=\begin{pmatrix} \psi_{e,+}(t,r) \\ \psi_{i,-}(t,r) \end{pmatrix}=N\begin{pmatrix} \dfrac{1}{4\pi r}e^{-iEt-r\alpha} \\ \dfrac{|\mathbf{p}_i|}{E+m}\dfrac{1}{4\pi r}e^{-iEt-r\alpha} \end{pmatrix}=N\begin{pmatrix} 1 \\ i\beta \end{pmatrix}e^{-iEt}\frac{1}{4\pi r}e^{-r\alpha} \tag{7.16}$$

According to this scenario, the nuclear spin of the neutron is solely due to the tightly bound spinized electron. Indeed, experimental data on charge distribution and *g*-factor of neutron support this scenario. We further suggest that the nuclear potential causing tight binding of the spinized electron in the neutron may have the form of expression (7.12). Detailed consideration will be given elsewhere.

The wave function of spinized proton described by equation (7.14) can be obtained by spinizing the solution in expression (7.15) as follows:

$$|\mathbf{p}_i|=\sqrt{\mathbf{p}_i^2}=\sqrt{-Det\boldsymbol{\sigma}\cdot\mathbf{p}_i}\rightarrow\boldsymbol{\sigma}\cdot\mathbf{p}_i=-i\boldsymbol{\sigma}\cdot\nabla \tag{7.17}$$

$$=-i\left(\left(\frac{\partial}{\partial_r}+\frac{1}{r}\right)\pm i\,\frac{j+1/2}{r}\right)I_2=\left(-i\left(\frac{\partial}{\partial_r}+\frac{1}{r}\right)\pm\frac{j+1/2}{r}\right)I_2$$

where *j* is the total angular momentum number. Choosing *j*=1/2, we obtain from expression (7.15) two sets of solutions as follows:

$$\psi(t,r)=\begin{pmatrix} \psi_{e,-}(t,r) \\ \psi_{i,+}(t,r) \end{pmatrix}=N\begin{pmatrix} \dfrac{-(1/r+i\alpha)}{E+m}\dfrac{1}{4\pi r}e^{+iEt-r\alpha} \\ 0 \\ \dfrac{1}{4\pi r}e^{+iEt-r\alpha} \\ 0 \end{pmatrix}=N\begin{pmatrix} \dfrac{-(1/r+i\alpha)}{E+m} \\ 0 \\ 1 \\ 0 \end{pmatrix}\frac{1}{4\pi r}e^{+iEt-r\alpha} \tag{7.18}$$

$$\psi(t,r)=\begin{pmatrix}\psi_{e,-}(t,r)\\ \psi_{i,+}(t,r)\end{pmatrix}=N\begin{pmatrix}0\\ \dfrac{-(-1/r+i\alpha)}{E+m}\dfrac{1}{4\pi r}e^{+iEt-r\alpha}\\ 0\\ \dfrac{1}{4\pi r}e^{+iEt-r\alpha}\end{pmatrix}=N\begin{pmatrix}0\\ \dfrac{-(-1/r+i\alpha)}{E+m}\\ 0\\ 1\end{pmatrix}\frac{1}{4\pi r}e^{+iEt-r\alpha} \qquad (7.19)$$

where $\alpha=\sqrt{m^2-E^2}$. In the case of timeless proton (that is, when $E$=0), we have from expressions (7.18) and (7.19) the following:

$$\psi(t,r)=\begin{pmatrix}\psi_{e,-}(t,r)\\ \psi_{i,+}(t,r)\end{pmatrix}=N\begin{pmatrix}-\left(\dfrac{1}{mr}+i\right)\dfrac{1}{4\pi r}e^{+iEt-mr}\\ 0\\ \dfrac{1}{4\pi r}e^{+iEt-mr}\\ 0\end{pmatrix}=N\begin{pmatrix}-\dfrac{1}{mr}-i\\ 0\\ 1\\ 0\end{pmatrix}e^{+iEt}\frac{1}{4\pi r}e^{-mr} \qquad (7.18)$$

$$\psi(t,r)=\begin{pmatrix}\psi_{e,-}(t,r)\\ \psi_{i,+}(t,r)\end{pmatrix}=N\begin{pmatrix}0\\ \left(\dfrac{1}{mr}-i\right)\dfrac{1}{4\pi r}e^{+iEt-mr}\\ 0\\ \dfrac{1}{4\pi r}e^{+iEt-mr}\end{pmatrix}=N\begin{pmatrix}0\\ \dfrac{1}{mr}-i\\ 0\\ 1\end{pmatrix}e^{+iEt}\frac{1}{4\pi r}e^{-mr} \qquad (7.19)$$

In this scenario, spinization of unspinized proton causes loss of tight binding of spinized electron to unspinized proton the possible cuase of which will be considered elsewhere.

## 8. GRAVITY (QUANTUM ENTANGLEMENT)

Gravity is quantum entanglement (instantaneous interaction) across the dual-world (see, e.g., Hu & Wu, 2006a-d, 2007a). There are two types of gravity at play. One is self-gravity (self-interaction) between the external object (external wave function) and internal object (internal wave function) of an entity (wave function) governed by the metamorphous Matrix Law described in this work and the other is the quantum entanglement (instantaneous interaction) between two entities or one entity and the dual-world as a whole which may be either attractive or repulsive. As further shown below, gravitational field (graviton) is just the wave function itself which expresses the intensity distribution and dynamics of self-quantum-entanglement (nonlocality) of an entity. Indeed, strong interaction actually is strong quantum entanglement (strong gravity). We point out here that some have suspected that strong interaction is strong gravity.

We focus here on three particular forms of gravitational fields. One is timeless (zero energy) external and internal wave functions (self-fields) which play the role of timeless graviton, that is, they mediate time-independent interactions through space quantum entanglement.

The second is spaceless external and internal wave functions (self-fields) which play the role of spaceless graviton, that is, they mediate space (distance) independent interactions through proper time (mass) entanglement. The third is massless external and internal wave functions (self-fields) which play the role of massless graviton, that is, they mediate mass (proper-time) independent interactions through massless energy entanglement. The typical wave function (self-fields) contains all three (timeless, spaceless and massless) components. In addition, the typical wave function also contains components related to fermionic or bosonic spinization.

As shown below, timeless quantum entanglement between two entities accounts for Newton gravity. Spaceless and/or massless quantum entanglement between two entities may account for dark matter (also see Hu & Wu, 2006) and Casimir effect. Importantly, gravitational components related to spinization may account for dark energy (also see Hu & Wu, 2006).

When $E$=0, we have from fundamental relationship (3.4):

$$-m^2 - \mathbf{p}^2 = 0 \quad \text{or} \quad m^2 + \mathbf{p}^2 = 0 \tag{8.1}$$

We can regard expression (8.1) as a relationship governing the Machian quantum universe in which the total energy is zero. Classically, this may be seen as: (1) the rest mass $m$ being comprised of imaginary momentum $\mathbf{P}=i\mathbf{P}_i$, or (2) momentum $\mathbf{P}$ being comprised of imaginary rest mass $m=im_i$.

As shown in § 3, the timeless Matrix Law in Dirac and Weyl form is respectively the following:

$$\begin{pmatrix} -m & -|\mathbf{p}| \\ -|\mathbf{p}| & +m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{8.2}$$

$$\begin{pmatrix} -|\mathbf{p}| & -m \\ -m & +|\mathbf{p}| \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{8.3}$$

Thus, the equations of the timeless wave functions (self-fields) are respectively as follows:

$$\begin{pmatrix} -m & -|\mathbf{p}| \\ -|\mathbf{p}| & +m \end{pmatrix} \begin{pmatrix} g_{D,e}e^{-iM} \\ g_{D,i}e^{-iM} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = L_M V_D = 0 \tag{8.4}$$

and

$$\begin{pmatrix} -|\mathbf{p}| & -m \\ -m & +|\mathbf{p}| \end{pmatrix} \begin{pmatrix} g_{W,e}e^{-iM} \\ g_{W,i}e^{-iM} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = L_M V_W = 0 \tag{8.5}$$

Equation (8.4) and (8.5) can be respectively rewritten as:

$$\begin{pmatrix} mV_{D,e} = -|\mathbf{p}|V_{D,i} \\ mV_{D,i} = |\mathbf{p}|V_{D,e} \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} V_{D,e} = -\dfrac{|\mathbf{p}|}{m}V_{D,i} \\ V_{D,i} = \dfrac{|\mathbf{p}|}{m}V_{D,e} \end{pmatrix} \tag{8.6}$$

and

$$\begin{pmatrix} mV_{W,e} = |\mathbf{p}|V_{W,i} \\ mV_{W,i} = -|\mathbf{p}|V_{W,e} \end{pmatrix} \quad \text{or} \quad \begin{pmatrix} V_{W,e} = \dfrac{|\mathbf{p}|}{m}V_{W,i} \\ V_{W,i} = -\dfrac{|\mathbf{p}|}{m}V_{W,e} \end{pmatrix} \tag{8.7}$$

To see the coupling of external and internal wave functions (self-fields) in a different perspective we can rewrite (8.6) and (8.7) respectively as follows:

$$\begin{pmatrix} mmV_{D,e}V_{D,i} = \left(-|\mathbf{p}|V_{D,i}\right)\left(|\mathbf{p}|V_{D,e}\right) \\ \left(|\mathbf{p}|V_{D,e}\right)\left(mV_{D,e}\right) = \left(mV_{D,i}\right)\left(-|\mathbf{p}|V_{D,i}\right) \end{pmatrix} \tag{8.8}$$

and

$$\begin{pmatrix} mmV_{W,e}V_{W,i} = \left(|\mathbf{p}|V_{W,i}\right)\left(-|\mathbf{p}|V_{W,e}\right) \\ \left(-|\mathbf{p}|V_{W,e}\right)\left(mV_{W,e}\right) = \left(mV_{W,i}\right)\left(-|\mathbf{p}|V_{W,i}\right) \end{pmatrix} \tag{8.9}$$

From expression (8.6), we can derive the following:

$$\left(m^2 + \mathbf{p}^2\right)V_{D,e} = 0 \quad \text{or} \quad \left(m^2 - \nabla^2\right)V_{D,e} = 0 \tag{8.10}$$

Equation (8.10) has radial solution in the form of Yukawa potential:

$$V_{D,e}(r) = \frac{1}{4\pi r}e^{-mr} \tag{8.11}$$

So in expression (8.4), *M=-imr*, that is, momentum is comprised of imaginary mass. The external timeless self-field in expression (8.11) has the form of Newton gravitational or Coulomb electric potential at large distance $r \to \infty$. We have from expression (8.6):

$$V_{D,i} = \frac{|\mathbf{p}|}{m}V_{D,e} = \frac{|\mathbf{p}|}{m}\frac{1}{4\pi r}e^{-mr} \to i\frac{1}{4\pi r}e^{-mr} \tag{8.12}$$

where we have utilized the following (for reason to be discussed elsewhere):

$$|\mathbf{p}|V_{D,e} = \sqrt{-\nabla^2}\,\frac{1}{4\pi r}e^{-mr} \to im\frac{1}{4\pi r}e^{-mr} \tag{8.13}$$

The complete radial solution of equation (8.4) is then:

$$V_D(r) = \begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = N\begin{pmatrix} \dfrac{1}{4\pi r}e^{-mr} \\ i\dfrac{1}{4\pi r}e^{-mr} \end{pmatrix} = N\begin{pmatrix} 1 \\ i \end{pmatrix}\frac{1}{4\pi r}e^{-mr} \tag{8.14}$$

where N is a normalization factor. Indeed, expression (8.7) can have same radial solution as expression (8.6):

$$V_W(r) = \begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = N \begin{pmatrix} \frac{1}{4\pi r} e^{-mr} \\ i\frac{1}{4\pi r} e^{-mr} \end{pmatrix} = N \begin{pmatrix} 1 \\ i \end{pmatrix} \frac{1}{4\pi r} e^{-mr} \tag{8.15}$$

If we assume that the internal self-field $V_{D,i}$ (which is self-coupled to its external self-field $V_{D,e}$ through expression (8.4) or (8.8)) also couples through timeless quantum entanglement with the external wave function $\psi_e$ of another entity of test mass $m_t$ (which is also self-coupled to its internal wave function $\psi_i$ ) as, for example:

$$i\kappa m V_{D,i} m_t \psi_e = i\kappa m i \frac{1}{4\pi r} e^{-mr} m_t \psi_e = -G\frac{m}{r} e^{-mr} m_t \psi_e \tag{8.16}$$

where $i\kappa$ is a coupling constant and $G=\kappa/4\pi$ is the Newton Gravitational Constant, we have gravitational potential at large distance $r\to\infty$ as:

$$V_g = -G\frac{m}{r} \tag{8.17}$$

We should point out here that in this work we shall not try to develop a full Hamiltonian for the two entities interacting through timeless quantum entanglement.

When $|\mathbf{p}|=0$, we have from fundamental relationship (3.4):

$$E^2 - m^2 = 0 \tag{8.18}$$

We can regard expression (8.6) as a relationship governing a spaceless quantum universe. Classically, this may be seen as the rest mass $m$ being comprised of time momentum (energy $E$). As shown in § 3, the spaceless Matrix Law in Dirac and Weyl form is respectively the following:

$$\begin{pmatrix} E-m & 0 \\ 0 & E+m \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{8.19}$$

and

$$\begin{pmatrix} E & -m \\ -m & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{8.20}$$

and the equation of spaceless wave functions (self- fields) are respectively the follows:

$$\begin{pmatrix} E-m & 0 \\ 0 & E+m \end{pmatrix} \begin{pmatrix} g_{D,e} e^{-imt} \\ g_{D,i} e^{-imt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} \begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = L_M V_D = 0 \tag{8.21}$$

and

$$\begin{pmatrix} E & -m \\ -m & E \end{pmatrix}\begin{pmatrix} g_{W,e}e^{-imt} \\ g_{W,i}e^{-imt} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = L_M V_W = 0 \qquad (8.22)$$

The external and internal (spaceless) wave functions $V_{D,e}$ and $V_{D,i}$ in equation (8.21) are decoupled from each other, but those in equation (8.22),$V_{W,e}$ and $V_{W,i}$, are coupled to each other:

$$\begin{pmatrix} EV_{D,e} = mV_{D,e} \\ EV_{D,i} = -mV_{D,i} \end{pmatrix} \quad \text{but} \quad \begin{pmatrix} EV_{W,e} = mV_{W,i} \\ EV_{W,i} = mV_{W,e} \end{pmatrix} \qquad (8.23)$$

It can be easily verified that the solutions to equation (8.21) are in forms of:

$$V_D = \begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = N\begin{pmatrix} 1e^{-imt} \\ 0e^{-imt} \end{pmatrix} = N\begin{pmatrix} 1 \\ 0 \end{pmatrix}e^{-imt} \qquad (8.24)$$

or

$$V_D = \begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = N\begin{pmatrix} 0e^{imt} \\ 1e^{imt} \end{pmatrix} = N\begin{pmatrix} 0 \\ 1 \end{pmatrix}e^{imt} \qquad (8.25)$$

but the solutions to equation (8.22) are in the forms of:

$$V_W = \begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = N\begin{pmatrix} 1e^{-imt} \\ 1e^{-imt} \end{pmatrix} = N\begin{pmatrix} 1 \\ 1 \end{pmatrix}e^{-imt} \qquad (8.26)$$

or

$$V_W = \begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = N\begin{pmatrix} 1e^{imt} \\ 1e^{imt} \end{pmatrix} = N\begin{pmatrix} 1 \\ 1 \end{pmatrix}e^{imt} \qquad (8.27)$$

As we shall illustrate below, most quantum entanglements one speaks of in quantum mechanics are spaceless quantum entanglement (gravity) between two entities, dark matter may be manifestation of this non-Newtonian gravity, and Casimir effect may be due to this type of spaceless quantum entanglement or, at least, may have contribution from spaceless quantum entanglement.

For simplicity, we will consider two mass $m_1$+$m_p$ and $m_2$ respectively located at space point 1 and 2. Their respective spaceless wave functions can be written in Weyl form as follows:

$$V_{1W+} = \begin{pmatrix} g_{1W+,e}e^{-i(m_1+m_p)t} \\ g_{1W+,i}e^{-i(m_1+m_p)t} \end{pmatrix} \quad \text{and} \quad V_{2W-} = \begin{pmatrix} g_{2W-,e}e^{-im_2t} \\ g_{2W-,i}e^{-im_2t} \end{pmatrix} \qquad (8.28)$$

which form product state $V_{1W+}V_{2W-}$. After $m_p$ leaves $V_{1W+}$ as an emitted particle and get absorbed by $V_{2W-}$, we may have the following two additional spaceless wave functions in Weyl form as follows:

$$V_{1W-} = \begin{pmatrix} g_{1W-,e}e^{-im_1 t} \\ g_{1W-,i}e^{-im_1 t} \end{pmatrix} \quad \text{and} \quad V_{2W+} = \begin{pmatrix} g_{2W+,e}e^{-i(m_2+m_p)t} \\ g_{2W+,i}e^{-i(m_2+m_p)t} \end{pmatrix} \tag{8.29}$$

which form product state $V_{1W-}V_{2W+}$. The final spaceless quantum state may be written as follows:

$$V = \frac{1}{\sqrt{2}}\left(V_{1W+}V_{2W-} + V_{1W-}V_{2W+}\right) = \frac{1}{\sqrt{2}}\left(|1+\rangle|2-\rangle + |1-\rangle|2+\rangle\right) \tag{8.30}$$

In this joint spaceless wavefunction, $m_1$ and $m_2$ are quantum entangled due to interaction with and through $m_p$. It is suggested that this space (distance) independent quantum entanglement (non-Newtonian gravity) between two entities is the cause of dark matter. It is further suggested that this space (distance) independent quantum entanglement (sharing of mass/energy) between two entities after interaction is the cause of or, at least, contribute to Casimir effect. We should point out here that in this work we shall not try to develop a full Hamiltonian for the two entities interacting through spaceless quantum entanglement.

When $m$=0, we have from fundamental relationship (3.4):

$$E^2 - \mathbf{p}^2 = 0 \tag{8.31}$$

We can regard expression (8.11) as a relationship governing the massless quantum universe in which the total rest mass (proper time) is zero. Classically, this may be seen as energy $E$ being comprised of momentum **p**. As shown in § 3, the massless Matrix Law in Dirac and Weyl form is respectively the following:

$$\begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{8.32}$$

and

$$\begin{pmatrix} E-|\mathbf{p}| & 0 \\ 0 & E+|\mathbf{p}| \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix} = L_M \tag{8.33}$$

and the equations of massless wave functions (self-fields) are respectively the follows:

$$\begin{pmatrix} E & -|\mathbf{p}| \\ -|\mathbf{p}| & E \end{pmatrix}\begin{pmatrix} g_{D,e}e^{-iM} \\ g_{D,i}e^{-iM} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = L_M V_D = 0 \tag{8.34}$$

and

$$\begin{pmatrix} E-|\mathbf{p}| & 0 \\ 0 & E+|\mathbf{p}| \end{pmatrix}\begin{pmatrix} g_{W,e}e^{-iM} \\ g_{W,i}e^{-iM} \end{pmatrix} = \begin{pmatrix} L_{M,e} & L_{M,i} \end{pmatrix}\begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = L_M V_W = 0 \tag{8.35}$$

Equations (8.34) and (8.35) have plane-wave solutions. The external and internal (masssless) wave functions $V_{D,e}$ and $V_{D,i}$ in equation (8.34) are coupled with each other, but those in equation (8.35), $V_{W,e}$ and $V_{W,i}$, are decoupled from each other:

$$\begin{pmatrix} EV_{D,e} = |\mathbf{p}|V_{D,i} \\ EV_{D,i} = |\mathbf{p}|V_{D,e} \end{pmatrix} \quad \text{but} \quad \begin{pmatrix} EV_{W,e} = |\mathbf{p}|V_{W,e} \\ EV_{W,i} = -|\mathbf{p}|V_{W,i} \end{pmatrix} \tag{8.36}$$

For eigenstate of E and $|\mathbf{p}|$, the solutions to equation (8.34) are in forms of:

$$V_D = \begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = N\begin{pmatrix} 1e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \\ \frac{|\mathbf{p}|}{E} e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \end{pmatrix} = N\begin{pmatrix} 1 \\ 1 \end{pmatrix} e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \tag{8.37}$$

or

$$V_D = \begin{pmatrix} V_{D,e} \\ V_{D,i} \end{pmatrix} = N\begin{pmatrix} \frac{|\mathbf{p}|}{E} e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \\ 1e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \end{pmatrix} = N\begin{pmatrix} 1 \\ 1 \end{pmatrix} e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \tag{8.38}$$

but the solutions to equation (8.35) are in the forms of:

$$V_W = \begin{pmatrix} V_{W,e} \\ V_{w,i} \end{pmatrix} = N\begin{pmatrix} 1e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \\ 0e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \end{pmatrix} = N\begin{pmatrix} 1 \\ 0 \end{pmatrix} e^{-i(\omega t - \mathbf{k}\cdot\mathbf{x})} \tag{8.39}$$

or

$$V_W = \begin{pmatrix} V_{W,e} \\ V_{W,i} \end{pmatrix} = N\begin{pmatrix} 0e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \\ 1e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \end{pmatrix} = N\begin{pmatrix} 0 \\ 1 \end{pmatrix} e^{i(\omega t - \mathbf{k}\cdot\mathbf{x})} \tag{8.40}$$

Equations (8.34) and (8.35) describe the self-interaction of external and internal massless and spinless wave functions (self-fields). We can build quantum-entangled state of two massless and spinless entities similar to that of two spaceless entities. It is suggested that this rest mass independent quantum entanglement (non-Newtonian gravity) between two massless entities may also contribute to the cause of dark matter (also see, Hu & Wu, 2006).

# 9. CONSCIOUSNESS

Our experimental results on quantum entanglement of the brain with external substances suggest that consciousness is not located in the brain but associated with prespacetime (Hu & Wu, 2006a-c). Thus, these results support the proposition that the transcendental aspect of consciousness is the basis of reality. Indeed, our view is that the reality is an interactive quantum reality centered on consciousness (GOD, ALLAH or prespacetime) and the interaction between consciousness and reality is the most fundamental self-reference (Hu, 2008b & 2009). The perplexing questions we have tried to answer are: (1) Is quantum reality produced and influence by consciousness; or (2) is consciousness produced and influenced by quantum reality? As shown in the preceding sections, our answers are that consciousness is both transcendent and immanent, that is, the transcendental aspect of consciousness produces and influences reality through self-referential spin as the interactive output of consciousness and, in turn, reality produces and influences immanent aspect of consciousness as the interactive input to consciousness also through self-referential spin (*Id.*).

We have also been asking the question: Where and what is human consciousness in the big scheme of things? Our answer is that human consciousness is a limited or individualized version of the above dual-aspect consciousness such that we have limited free will and limited observation/experience which is mostly classical at macroscopic levels but quantum at microscopic levels (*Id.*). For example, as a limited transcendental consciousness, we have through free will the choice of what measurement to do in a quantum experiment but not the ability to control the result of measurement (at least not until we can harness the abilities of our consciousness). That is, the result appears to us as random. On the other hand, at the macroscopic level, we also have the choice through free will of what to do but the outcome, depending on context, is sometimes certain and at other times uncertain. Further, as a limited immanent consciousness, we can only observe the measurement result in a quantum experiment which we conduct and experiences the macroscopic environment surrounding us as the classical world (*Id.*).

With these "big" questions out of the way, we now focus on some details of how human experience (as limited immanent consciousness) is produced through the brain and how human free-will (as limited transcendental consciousness) may operate through the brain. These questions have also been considered by us previously.

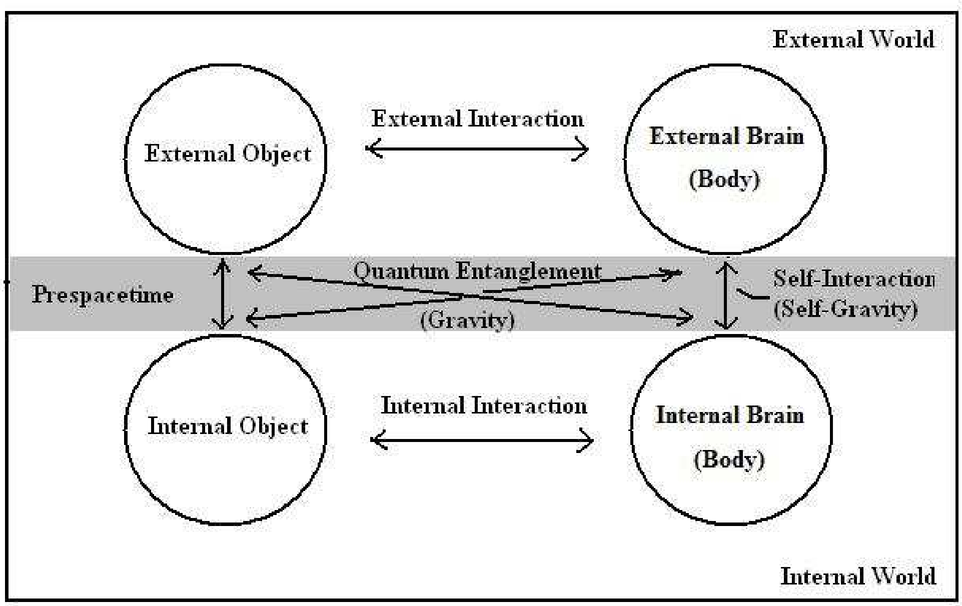


Figure 9.1 Interaction between an object and the brain (body) in the dual-world

As illustrated in Figure 9.1, there are two kinds of interactions between an object (entity) outside the brain (body) and the brain (body). The first and commonly known kind is the direct physical and/or chemical interactions such as sensory input through the eyes. The second and less-known kind but experimentally proven to be true is the instantaneous interactions through quantum entanglement. The entire world outside our brain (body) is associated with our brain (body) through quantum entanglement thus influencing and/or generating not only our feelings, emotions and dreams but also the physical, chemical and physiological states of our brain and body.

Importantly, quantum entanglement may participate in sensory experience such as vision, for example, as follows (Keep in mind that an interaction in the external world is accompanied by its counterpart interaction in the internal world): (1) A light ray reflected and/or emitted from an object outside the brain enters the eye, gets absorbed, converted and amplified in the retina as propagating action potentials which travel to the central nervous system (CNS); (2) In the CNS, the action potentials drive and influence the mind pixels which according our theory is the nuclei such protons with net nuclear spins and and/or electrons with unpaired spins; and (3) Either the driven or influenced dynamic patterns of the mind-pixels in the internal world form the experience of the object, or more likely our visual experience of the object is the direct experience of the object in the external world through quantum entanglement established by the physical interactions. In the latter case, there is no image of the outside world in the brain. Further, in the case that the object outside the brain is an image such as a photograph, there is also the possibility that our visual experience is not only the experience of the photograph as such through quantum entanglement but also experience of the object within the photograph through additional quantum entanglement. We hope that through careful experiments, we can find out which mechanism is actually true or whether both are true in reality.

The action potentials in the retina, the neural pathways and the CNS are driven by voltage-gated ion channels on neural membranes as embodied by the Hodgkin-Huxley model:

$$\partial_t V_m = -\frac{1}{C_m}\left(\sum_i (V_m - E_i) g_i\right) \tag{9.1}$$

where $V_m$ is the electric potential across the neural membranes, $C_m$ is the capacitance of the membranes, $g_i$ is the $i$th voltage-gated or constant-leak ion channel (also see, Hu & Wu, 2004c & 2004d). The overall effect of the action potentials and other surrounding factors, especially the magnetic dipoles carried by oxygen molecules due to their two unpaired electrons, is that inside the neural membranes and proteins, there exist varying strong electric field **E** and fluctuating magnetic field **B** which are also govern by the Maxwell equation:

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix} \boldsymbol{\sigma}\cdot\mathbf{E} \\ i\boldsymbol{\sigma}\cdot\mathbf{B} \end{pmatrix} = 0 \quad \text{or} \quad \begin{pmatrix} \partial_t \mathbf{E} = \nabla\times\mathbf{B} \\ \partial_t \mathbf{B} = -\nabla\times\mathbf{E} \\ \nabla\cdot\mathbf{E} = 0 \\ \nabla\cdot\mathbf{B} = 0 \end{pmatrix} \tag{9.3}$$

where we have set the classical (macroscopic) electric density and current $j^{\mu}=(\rho,\mathbf{j})=0$ inside the neural membranes. Further, for simplicity, we have not considered the medium effect of the membranes, that is, we have treated the membranes as a vacuum.

Microscopically, electromagnetic field **E** and **B** or their electromagnetic potential representation $A^{\mu}=(\phi,\mathbf{A})$:

$$\begin{pmatrix} \mathbf{E}=-\nabla\phi-\partial_t\mathbf{A} \\ \mathbf{B}=\nabla\times\mathbf{A} \end{pmatrix} \tag{9.4}$$

interacts with proton with charge *e* and unpaired electron with charge –*e* respectively as the following Dirac-Maxwell systems:

$$\left(\begin{pmatrix} E-e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) & E-e\phi+m \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix}=L_M\psi=0\right)_p \tag{9.5}$$

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix} \boldsymbol{\sigma}\cdot\mathbf{E} \\ i\boldsymbol{\sigma}\cdot\mathbf{B} \end{pmatrix}=\begin{pmatrix} -i\boldsymbol{\sigma}\cdot(\psi^{\dagger}\beta\boldsymbol{\alpha}\psi) \\ -i(\psi^{\dagger}\beta\beta\psi) \end{pmatrix}_p \tag{9.6}$$

and

$$\left(\begin{pmatrix} E+e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}+e\mathbf{A}) & E+e\phi+m \end{pmatrix}\begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix}=L_M\psi=0\right)_e \tag{9.7}$$

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix}\begin{pmatrix} \boldsymbol{\sigma}\cdot\mathbf{E} \\ i\boldsymbol{\sigma}\cdot\mathbf{B} \end{pmatrix}=\begin{pmatrix} -i\boldsymbol{\sigma}\cdot(\psi^{\dagger}\beta\boldsymbol{\alpha}\psi) \\ -i(\psi^{\dagger}\beta\beta\psi) \end{pmatrix}_e \tag{9.8}$$

where $\beta$ and $\boldsymbol{\alpha}$ are Dirac matrices.

In equations (9.5) and (9.7), the interactions (couplings) of **E** and/or **B** with proton and/or electron spin operator $(\boldsymbol{\sigma})_p$ and $(\boldsymbol{\sigma})_e$ are hidden. But they are due to self-referential Matrix Law which causes mixing of the external and internal wave functions and can be made explicit in the determinant view as follows. For Dirac form, we have:

$$\left(\begin{pmatrix} E-e\phi-m & -\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) \\ -\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) & E-e\phi+m \end{pmatrix}\begin{pmatrix} \psi_{e,-} \\ \psi_{i,+} \end{pmatrix}=L_M\psi=0\right)_p \tag{9.9}$$

$$\rightarrow\left(\begin{pmatrix} (E-e\phi-m)(E-e\phi+m)- \\ \\ (-\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}))(-\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A})) \end{pmatrix}I_2\psi_{e,-}\psi^{*}_{i,+}=0\right)_p$$

$$\rightarrow\left(\left((E-e\phi)^2-m^2-(\mathbf{p}-e\mathbf{A})^2+e\boldsymbol{\sigma}\cdot\mathbf{B}\right)I_2\psi_{e,-}\psi^{*}_{i,+}=0\right)_p$$

For Weyl (chiral) form, we have:

$$\left(\begin{pmatrix} E-e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) & -m \\ -m & E-e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}) \end{pmatrix}\begin{pmatrix}\psi_{e,r} \\ \psi_{i,l}\end{pmatrix}=0\right)_p \tag{9.10}$$

$$\rightarrow\left(\left((E-e\phi-\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}))(E-e\phi+\boldsymbol{\sigma}\cdot(\mathbf{p}-e\mathbf{A}))-m^2\right)I_2\psi_{e,r}\psi^*_{i,l}=0\right)_p$$

$$\rightarrow\left(\left((E-e\phi)^2-m^2-(\mathbf{p}-e\mathbf{A})^2+e\boldsymbol{\sigma}\cdot\mathbf{B}\text{-}ie\boldsymbol{\sigma}\cdot\mathbf{E}\right)I_2\psi_{e,r}\psi^*_{i,l}=0\right)_p$$

These two couplings are also explicitly shown in Dirac-Hestenes formulism or during the process of non-relativistic approximation of the Dirac equation in the present of external electromagnetic potential $A^\mu$. We can carry out same procedures for electron to show the explicit couplings of $(\boldsymbol{\sigma})_e$ with **E** and **B**.

One effect of the couplings is that the action potentials through **E** and **B** (or $A^\mu$) input information into the mind-pixels in the brain (Hu & Wu, 2004c, 2004d & 2008a). Judging from the above Dirac-Maxwell systems, we are inclined to think that the said information is likely carried in the temporal and spatial variations of **E** and **B** (frequencies and timing of neural electric spikes and their spatial distribution in the CNS). Another possible effect of the couplings is that they allow transcendental aspect of consciousness through wave functions (the self fields) of the proton and/or electron to back-influence **E** and **B** (or $A^\mu$) which in turn back-affect the action potentials through the Hodgkin-Huxley neural circuits in the CNS (also see, Hu & Wu, 2007d & 2008a).

We will carry out detailed studies of the above sketched possible mechanisms elsewhere. Here we will speculate a bit about how human free-will as a macroscopic quality of limited transcendental consciousness may originate microscopically under the particular high electric voltage environment inside the neural membranes. For example, one possibility is that the human free will as thought or imagination produces changes in the phase of external and internal wave functions:

$$e^{i0}=e^{-i(\Delta Et-\Delta\mathbf{p}\cdot\mathbf{x})+i(\Delta Et-\Delta\mathbf{p}\cdot\mathbf{x})}=\left(e^{-i(\Delta Et-\Delta\mathbf{p}\cdot\mathbf{x})}\right)_e\left(e^{+i(\Delta Et-\Delta\mathbf{p}\cdot\mathbf{x})}\right)_i \tag{9.13}$$

where $(\ )_e$ and $(\ )_i$ respectively indicate external and internal wave functions, which in turn back-affect **E** and **B** (or $A^\mu$) in the high electric voltage neural membranes through the Dirac Maxwell systems illustrated above.

## 10. APPLICATIONS, PREDICTIONS, QUESTIONS & ANSWERS

As we mentioned earlier, in part breakthrough in this work came as we struggled to find answers to fundamental questions posed by our own experimental results (Hu & Wu, 2006b, 2006c, 2006d & 2007a). One of such questions was: How is it possible for a person located in one place to feel the effect of an anesthetic applied to quantum-entangled water sample located at another location as if the person has actually inhaled or ingested the said anesthetic? The simplest answer is that our consciousness is not located within spacetime but within prespacetime or simply is prespacetime itself as we have theorized ourselves earlier but might be reluctant to accept without experimental proof (Hu & Wu, 2003, 2004b & 2006a; also see Hu, 2009).

Another key question was: How is it possible for the temperature of a water sample located at one place to increase or decrease against the temperature of local environment while the quantum-entangled water sample at a different location is manipulated? One answer is that the energies in the two samples can exchange nonlocally. This is permitted within the principle formulated in this work. Yet, another answer is that the external energy and internal energy of the water sample being measured can be created or annihilated locally under the influence of the remote manipulation through quantum entanglement as illustrated in expression (9.13) and (5.11) respectively. This latter answer is also permitted within the principle formulated in this work. Further, it is possible that both these mechanisms are at play. Only further experiments will tell.

Yet a third key question was: How is it possible for the weight of a water sample located at one place to increase or decrease against the gravity of earth at that location while the quantum-entangled water sample at another location is manipulated? One answer is that the weight of the sample being measured can change due to spaceless quantum entanglement with the sample being manipulated as formulated in this work. Further, timeless quantum entanglement as formulated in this work may also play a role in the weight change in the sample being measured.

Indeed, many other applications and predictions can be drawn and they will be considered elsewhere if and when time permits. For now we will list some fundamental questions about existence, life and consciousness and give our answers (some are tentative) to them in the context of the principle of existence illustrated in this work. We hope that these questions and answer will also serve as a response to many anticipated questions related to this work. Further, we will make some predictions and point out some applications also in the form of questions and answers below.

Questions & Answers

1. Was there a Creator of the Universe? Yes. The Creator is GOD, ALLAH, Consciousness or Prespacetime which is omnipotent, omniscient and omnipresent.

2. Was there something before the Universe was born (if there was a birth)? Yes. GOD alone ($1=e^0$) without differentiation or dualization. So, it may be said that $1=\mathbf{e}^0=\mathbf{e}^{iM-iM}=\mathbf{e}^{iM}\mathbf{e}^{-iM}=\mathbf{e}^{-iM}/\mathbf{e}^{-iM}=\mathbf{e}^{iM}/\mathbf{e}^{iM}$…is the GOD particle.

3. How does GOD create, sustain and cause evolution of the Universe and all entities in it? GOD does these things by hierarchical self-referential spin of ITS mind and body at ITS free will.

4. Why there is materially something instead of nothing? GOD is restless and love to create, sustain and make evolutions of different entities so as to entertain ITSELF.

5. How does GOD govern the Universe? GOD governs through metamorphous self-referential Matrix Law.

6. What is matter? Matter is a dualized entity (created through hierarchical self-referential spin of GOD's mind and body) comprised of an external wave function (external object) having positive mass/energy by convention and an internal wave function (internal object) having negative mass/energy by convention.

7. What is antimatter? Antimatter is a dualized entity (created through hierarchical self-referential spin of GOD's mind and body) comprised of an external wave function (external object) having negative mass/energy by convention and an internal wave function (internal object) having positive mass/energy by convention.

8. Is energy conserved in the dual-world? Yes, energy is conserved to zero according to the accounting principle of zero.

9. Is energy conserved in the external (internal) world alone? The answer depends on the context. In most natural processes, external (internal) energy is conserved and transformed into different forms without loss due to cancellation between the external and internal worlds. However, in some processes, especially these involving human consciousness and/or intention (free will), energy conservation in external (internal) world maybe slightly violated so that the free will may function. We emphasize here that experiments are the keys here to get the scientific answers. Also, violation of energy conservation in the external (internal) world may occur in certain cosmic processes (e.g., in the Sun) or in certain weak interactions as will be considered elsewhere.

10. What is quantum entanglement? It is the interaction and/or connections between the external and internal wave functions (objects) of a single dualized entity or among different dualized entities through prespacetime which is outside spacetime.

11. What is self-interaction, self-gravity or self-quantum entanglement? Self-interaction is the interaction between the external and internal wave functions (objects) according to the GOD equation governed by the self-referential Matrix Law.

12. What is strong force? It is likely downward self-reference through imaginary momentum. It is strong gravity (strong quantum entanglement).

13. What is weak force? It is fermionic spinization and unspinization of spinless entities with or without bosonic intermediary spinization.

14. What is electromagnetic force? It is bosonic spinization and unspinization of massless and spinless entity.

15. What is gravity? It is quantum entanglement across the dual world which include self-gravity or self-quantum-entanglement between the external and internal wave functions (objects) of a single dualized entity and gravity or quantum entanglement among different entities.

16. What is Newtonian Gravity? It is instantaneous action at large distance caused by timeless quantum entanglement.

17. What is dark matter? Our tentative answer is that it is a nonlocal effect caused by spaceless quantum entanglement.

18. What is dark energy? Our tentative answer is that it is a nonlocal effect caused by quantum entanglement associated with fermionic and/or bosonic spinization.

19. What is a black hole, white hole or white-black hole? It is likely that the black hole in the sense of General Relativity is a mathematical artifact since it seems that general relativity does not take the internal world, the negation of external world, into consideration. Therefore, there is likely only the appearance of black hole. The internal wave function (object) appears to the external wave function (object) as a black hole, *visa versa*. The external wave function (object) alone appears to be a white hole, so an entity comprised of the external and internal wave functions (objects) appear to be a black white hole depending on one's perspective.

20. What is the origin of Casimir Effect? Casimir effect is or has contribution from spaceless quantum entanglement due to energy/mass exchange between two entities.

21. What is the origin of quantum effect? The origin is primordial hierarchical self-referential spin of GOD's mind and body or prespacetime.

22. Does Higgs Boson exist? No, it is likely a mathematical artifact due to the particular gauge-invariant Lagrangian formulation.

23. What is information? It is a distinction (either quantitative or qualitative) experienced or perceived by a particular consciousness.

24. What is quantum information? It is a distinction or a state of distinction (either quantitative or qualitative) experienced or perceived by a particular consciousness which is due to quantum effect such as quantum entanglement.

25. What is the meaning of imaginary unit *i*? It is the most elementary self-referential process. As imagination in Godhead, it makes phase distinction of an elementary entity and

as an element in the Matrix Law it play crucial role in GOD's self-referental matrixing creation.

26. What is your view on Godel's Incompleteness Theorem? It is a reflection of the self-referential nature of mathematics.

27. What's your understanding of the measurement problem or how classical world appears? Classical world appears as the result of hierarchical collapsing or focusing of the quantum reality through the free will of unlimited and/or limited transcendental aspect of consciousness. By way of an example, a stone, mountain or earth appears to a human consciousness as classical object because the unlimited consciousness has already collapsed/focused it for the human consciousness. Therefore, on the macroscopic level, when we are not looking at the moon, the moon is still there and when we throw a stone at two holes, we will be able to observe both the hole the stone will pass and the location it will land. On the other hand, microscopically, when we are not measuring the position of an electron, it may be at the location we want to measure or may be not. That is, our limited free will have the choice of where and when to do the measurement but the answer we get appears to be random since the position the electron is to be found is determined by GOD's free will.

28. What is Consciousness? Consciousness is the basis of quantum reality. It is GOD, ALLAH, or Prespacetime which is omnipotent, omniscient and omnipresent.

29. What is human consciousness? It is a limited or individualized Consciousness associated with a particular human brain/body.

30. Does human consciousness reside in human brain? No, the human brain is the interface for human consciousness to experience and interact with the external world.

31. What are spirit, soul and/or mind? They are different aspects or properties of Consciousness which is transcendent, immanent and eternal.

32. What is the essence of Special Theory of Relativity? The essence of Special Theory of Relativity is that the speed limit $c$ is applicable in interactions in each of the dual world but not interactions across the dual-world. Indeed, the reason that no external object can move faster than the speed of light and the same gets heavier and heavier as its speed approach the speed of light is due to its increased quantum entanglement with the internal world through its counterpart the internal object.

33. What is your opinion on General Theory of Relativity? If the speed of gravitational interaction based on General Relativity is limited to the speed of light, General Relativity is against experience/experiments thus ontologically invalid. Otherwise, it should be derivable from the properties of quantum entanglement. In any case, it may still be used or treated as an effective or approximate theory.

34. What is your view on the second law of thermodynamics? It is approximately valid but may be violated under some circumstances such as when human intention/consciousness or nonlocal process such as those mediated by quantum entanglement is involved.

35. What is your opinion on the so called hard problem of consciousness? This problem arises as a defect of the materialistic philosophy of consciousness which denies that consciousness is the foundation of quantum reality and conscious experience is a feature of the dual-world which is the universe.

36. Where did we come from? Physically/biologically, we came from GOD as ITS creation. Spiritually, we are inseparable part of GOD and our consciousness is limited and/or individualized version of GOD's consciousness.

37. Where are we going? Physically/biologically, we disintegrate or die unless we advance our science to the point where death of our biological body becomes a choice not unavoidability. Also, we are of the opinion that advancement in science will eventually enable us to transfer or preserve our individual consciousness associated with our ailing or diseased body to another biological or artificial host. Spiritually, we may go back to GOD or reincarnate into a different form of individual consciousness which may be able to recall its past (but not sure yet on the latter point).

38. How mind influence brain? Mind influences the brain through free will which acts on subjective entities (internal objects) which in turn affect objective entities (external objects) through GOD Equation.

39. Do you believe in paranormal phenomena? They are likely real and explainable by quantum entanglement. But the effect is likely very small.

40. What is your opinion on homeopathy? It is likely real effect and explainable by quantum entanglement. But the effect is very small and clinically maybe ineffective.

41. Do you believe in UFOs? Theoretically, they are plausible.

42. What is the origin of uncertainty principle? The origin is self-referential spin or zitterbewegung.

43. What is the origin of quantum jump or wave collapse? The free will of GOD or unlimited transcendental consciousness in order to observe or experience the universe IT created. Please remember that our limited free will is part of GOD's unlimted free will since we are part of GOD.

44. Is the total entropy of the universe conserved? Yes, it is conserved to zero in the dual world but is not conserved in each world alone.

45. What is your view of Mach principle? It is our opinion that the Universe is a Machian quantum universe in which the total energy of the dual world is zero.

46. Is information conserved? It is our opinion that information is conserved to zero in the dual world since each distinction in the external world is accompanied by its negation in the internal world. However, information is not conserved in each world alone.

47. What is a graviton? There is no graviton in the sense of a quantum (particle) which mediated gravitational interaction at the speed of light. However, since gravity is quantum entanglement, the wave function of each entity may be treated as a graviton.

48. Does repulsive gravitational force exit? Maybe, gravity between electron and proton is possibly repulsive but it needs experimental verification.

49. Is there an absolute reference frame? Yes, it is simply prespacetime (GOD, ALLAH or Consciousness).

# 11. CONCLUSION

As submitters to truth, searching for truth and our Creator, if IT does exist, is the ultimate treasure hunt. Many before us have been on this sacred journey. Some find it spiritually, some got close, some got lost, some gave up, some gave their lives in the process, and some went astray and hostile. Perhaps, scientifically we have gotten closer and/or even been actually there. As proof, we have brought back and reported in our previous papers and this work what we have found and believed to be a few pieces of this great treasure and a practical map for fellow truth seekers to analyze and use. The pieces we found and brought back are both experimental and theoretical. Experimentally, we have demonstrated that: (1) Consciousness is associated with (or simply is) prespacetime and our brain is the vehicle for conscious experiences and operations (feedbacks); and (2) there exist an instantaneous transcendental force (quantum entanglement or gravity) beyond spacetime which makes omnipotence, omnipresence and omniscience of Consciousness (GOD, ALLAH or prespacetime) possible and feasible. Theoretically, we have presented a detailed model of spin-mediated consciousness previously and, in this work, an ontological and mathematical model (Principle of Existence) centered on Consciousness which through multifaceted and hierarchical self-referential spin creates, sustains, experience and causes evolution of the Universe.

However, since the place of the treasure is so large and the pieces of the treasure so many, we have only managed to glance at many but brought back a few due to our limited capacity and imperfect skills. Or perhaps, some are not brought back so that others may share the joy of finding and bringing them back. After all, what is the fun to bring back many just by ourselves, even if we have the capacity and skills to do so? Even worse, if the pieces we have brought back would not be genuine or recognized as such, what is the point of bringing back more? It will be much more fun and joy if all truth seekers can analyze and use what we have brought back and the map we have drawn and participate in this most sacred journey and treasure hunt.

One of the key features of the principle of existence illustrated in this work is the development and use of hierarchical self-referential mathematics in order to accommodate both the transcendental and imminent qualities/properties of Consciousness (GOD, ALLAH or Prespacetime). Needless to say, this potential new branch/direction of mathematics is in its infancy and we have not attempted a systematic presentation in this work. We hope that mathematicians will see the virtue in our work and, indeed, participate in the development of the new mathematics.

To recapitulate, we have in this work laid out an ontological and mathematical foundation towards a theory of everything which includes gravity and centers on Consciousness. If we are on the right path, we hope that our efforts mark a new beginning in the pursuit of the Holy Grail of science (and religion).

In the beginning there was prespacetime (GOD) $\mathbf{e}^{h}$ by itself $\mathbf{e}^{0}$ =1materially empty and spiritually restless. And it began to imagine through primordial self-referential spin $1=\mathbf{e}^{0}=\mathbf{e}^{iM-iM}=\mathbf{e}^{iM}\mathbf{e}^{-iM}=\mathbf{e}^{-iM}/\mathbf{e}^{-iM}=\mathbf{e}^{iM}/\mathbf{e}^{iM}\ldots$ such that it created the external object to be observed and internal object as observed, separated them into external world and internal world, cause them to interact through self-referential Matrix Law and thus gave birth to the Universe which it has since passionately loved, sustained and made to evolve.

In this Universe, Godbody (ether or aether), represented by Euler number **e**, is the ground of existence and can form external and internal wave functions as external and internal objects (each pair forms an elementary entity) and interaction fields between elementary entities which accompany the imaginations of Godhead ***h***. Godbody can be self-acted on by GOD's self-referential Matrix Law $\boldsymbol{L_M}$. Godhead ***h*** has imagining power ***i*** to project external and internal objects by projecting, e.g., external and internal phase $\pm$M $=\pm(Et-\mathbf{p}\cdot\mathbf{x})/\hbar$ above Godbody **e**. The Universe so created is a dual-world comprising of the external world to be observed and internal world as observed under each relativistic frame $x^{\mu}=(t, \mathbf{x})$. In one perspective of GOD's eye view, the internal world (which by convention has negative energy) is the negation/image of the external world (which by convention has positive energy). The absolute frame of reference is the Godbody (ether). Thus, if GOD stops imagining ($\mathbf{h}=\boldsymbol{i}0=0$), the Universe would disappear into materially nothingness $\mathbf{e}^{\boldsymbol{i}0}=\mathbf{e}^{0}=1$.

The accounting principle of the dual-world is conservation of zero. For example, the total energy of an external object and its counterpart, the internal object, is zero. Also in this dual-world, self-gravity is the nonlocal self-interaction (wave mixing) between an external object in the external world and its negation/image in the internal world, that is, the negation appears to its external counterpart as a black hole *visa versa*. Gravity is the nonlocal interaction (quantum entanglement) between an external object with the internal world as a whole. Some other most basic conclusions are: (1) the two spinors of the Dirac electron or positron are respectively the external and internal objects of the electron or positron; (2) the electric and magnetic fields of a linear photon are respectively the external and internal objects of a photon which are always self-entangled; (3) the proton is likely a spatially confined (hadronized) positron through imaginary momentum (downward self-reference); and (4) a neutron is likely comprised of a unspinized (spinless) proton and a bound and spinized electron. In this dual-world, consciousness is simply prespacetime (GOD) having both transcendental and immanent properties/qualities. The transcendental aspect of consciousness is the origin of primordial self-referential spin (including the self-referential Matrix Law) and it projects the external and internal worlds through spin and, in turn, the immanent aspect of consciousness observes the external world as the observed internal world through the said spin. Human consciousness is a limited and particular version of this dual-aspect consciousness such that we have limited free will and limited observation which is mostly classical at macroscopic levels but quantum at microscopic levels.

The above ideas (ontology) are forced upon (or rather reveal to) us by our recent theoretical and experimental studies (Hu & Wu, 2006a-d, 2007a). Among other things, we experimentally demonstrated that gravity is the manifestation of quantum entanglement (*Id.*). We materially live in the external world but experience the external world through its negation, the internal world in the relativistic frame $x^{\mu}=(t, \mathbf{x})$ attached to each of our bodies. Interactions within the external world and the internal world are local interactions and conform to special theory of relativity. But interactions across the dual world are nonlocal interactions (quantum entanglement). Strong interaction is likely spatially confining nonlocal self-interaction and nonlocal interaction among spatially confined fermions (hadrons).

Therefore, the meaning of the special theory of relativity is that the speed limit *c* is only applicable in each of the dual world but not interactions between the dual-world. Indeed, the reason that no external object can move faster than the speed of light and the same gets heavier and heavier as its speed approach the speed of light is due to its increased quantum entanglement with the internal world through its counterpart the internal object.

**Dedication, Tribute & Acknowledgements**:

We dedicate this work to our Creator whose light, grace and mercy have shone on us the believers and whose truth and purpose we strive to serve above all else at ITS appointed time and place in this living Universe which is ITS Creation. IT willing, we further dedicate this work to ITS Prophets, Son, Messengers and other devoted Servants such as Moses, Jesus, Muhammad, Buddha, the originator of Hinduism and the originator of Tao.

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# [SELF-]REFERENCE

Hu, H. & Wu, M. Mechanism of anesthetic action: oxygen pathway perturbation hypothesis. Med. Hypotheses 2001a: 57: 619-627. Also see arXiv 2001b; physics/0101083.

Hu, H. & Wu, M. Spin-mediated consciousness theory. arXiv 2002; quant-ph/0208068. Also see Med. Hypotheses 2004a: 63: 633-646.

Hu, H. & Wu, M. Spin as primordial self-referential process driving quantum mechanics, spacetime dynamics and consciousness. NeuroQuantology 2004b; 2:41-49. Also see Cogprints: ID2827 2003.

Hu, H. & Wu, M. Action potential modulation of neural spin networks suggests possible role of spin in memory and consciousness. NeuroQuantology 2004c; 2:309-316. Also see Cogprints: ID3458 2004d.

Hu, H. & Wu, M. Thinking outside the box: the essence and implications of quantum entanglement. NeuroQuantology 2006a; 4: 5-16.

Hu, H. & Wu, M. Photon induced non-local effect of general anesthetics on the brain. NeuroQuantology 2006b 4: 17-31. Also see Progress in Physics 2006c; v3: 20-26.

Hu, H. & Wu, M. Evidence of non-local physical, chemical and biological effects supports quantum brain. NeuroQuantology 2006d; 4: 291-306. Also see Progress in Physics 2007a; v2: 17-24.

Hu, H. & Wu, M. Thinking outside the box II: the origin, implications and applications of gravity and its role in consciousness. NeuroQuantology 2007b; 5: 190-196.

Hu, H. & Wu, M. On dark chemistry: what's dark matter and how mind influences brain through proactive spin. NeuroQuantology 2007c; 5: 205-213.

Hu, H. & Wu, M. Concerning spin as mind-pixel: how mind interacts with the brain through electric spin effects. NeuroQuantology 2008a; 6: 26-31.

Hu, H. The state of science, religion and consciousness. NeuroQuantology 2008b; 6: 323-332.

Hu, H. Quantum enigma - physics encounters consciousness (book review). Psyche 2009; 15: 1-4.