

Application of Prespacetime Model II

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ABSTRACT

Some applications of Prespacetime Model II are stated. The applications relate to presenting and modeling energy-momentum-mass relationship, self-referential matrix rules, elementary particles and composite particles through self-referential hierarchical spin in prespacetime. In particular, method and model for generating energy-momentum-mass relationship, self-referential matrix rules, elementary particles and composite particles are stated.

Key Words: prespacetime, spin, self-reference, elementary particule, fermion, boson, unspinzied particle, generation, sustenance, evolution, energy-momentum relation.

I. Modeling Method Based on Prespacetime Model II

(1) A method for presenting and/or modeling generation of an energy-momentum-mass relationship of an elementary particle through hierarchical self-referential spin in prespacetime, as a research aide, teaching tool and/or game, comprising the steps of:

generating a first representation of said spin producing said energy-momentum-mass relationship of said elementary particle through said hierarchical self-referential spin in said prespacetime, said first representation comprising:

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

where e is natural exponential base, i is imaginary unit, L is a phase, E , m and \mathbf{p} represent respectively energy, mass and momentum of said elementary particle, and speed of light c is set equal to one; and

presenting and/or modeling said first representation in a device for research, teaching and/or game.

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(2) A method as in (1) wherein said first representation is modified to include an electromagnetic potential (\mathbf{A}, ϕ) generated by a second elementary particle, said modified representation comprising:

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

$$\left(\frac{m}{E - e\phi} - i \frac{|\mathbf{p} - e\mathbf{A}|}{E - e\phi} \right) \left(\frac{m}{E - e\phi} + i \frac{|\mathbf{p} - e\mathbf{A}|}{E - e\phi} \right) =$$

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

where e next to ϕ or \mathbf{A} is electric charge of said elementary particle.

(3) A method as in (1) for presenting and/or modeling generation of a self-referential matrix rule further comprising the steps of:

generating a second representation of said spin forming said matrix rule from said energy-momentum-mass relationship, said second representation comprising:

$$\rightarrow 1 = \frac{E^2 - m^2}{\mathbf{p}^2} = \left(\frac{E - m}{-|\mathbf{p}|} \right) \left(\frac{-|\mathbf{p}|}{E + m} \right)^{-1} \rightarrow \frac{E - m}{-|\mathbf{p}|} = \frac{-|\mathbf{p}|}{E + m} \rightarrow \frac{E - m}{-|\mathbf{p}|} - \frac{-|\mathbf{p}|}{E + m} = 0$$

$$\rightarrow \begin{pmatrix} E - m & -|\mathbf{p}| \\ -|\mathbf{p}| & E + m \end{pmatrix} \rightarrow \begin{pmatrix} E - m & -\boldsymbol{\sigma} \cdot \mathbf{p} \\ -\boldsymbol{\sigma} \cdot \mathbf{p} & E + m \end{pmatrix} \text{ or } \begin{pmatrix} E - m & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E + m \end{pmatrix},$$

$$\rightarrow 1 = \frac{E^2 - \mathbf{p}^2}{m^2} = \left(\frac{E - |\mathbf{p}|}{-m} \right) \left(\frac{-m}{E + |\mathbf{p}|} \right)^{-1} \rightarrow \frac{E - |\mathbf{p}|}{-m} = \frac{-m}{E + |\mathbf{p}|} \rightarrow \frac{E - |\mathbf{p}|}{-m} - \frac{-m}{E + |\mathbf{p}|} = 0$$

$$\rightarrow \begin{pmatrix} E - |\mathbf{p}| & -m \\ -m & E + |\mathbf{p}| \end{pmatrix} \rightarrow \begin{pmatrix} E - \boldsymbol{\sigma} \cdot \mathbf{p} & -m \\ -m & E + \boldsymbol{\sigma} \cdot \mathbf{p} \end{pmatrix} \text{ or } \begin{pmatrix} E - \mathbf{s} \cdot \mathbf{p} & -m \\ -m & E + \mathbf{s} \cdot \mathbf{p} \end{pmatrix},$$

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

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

$$\rightarrow \begin{pmatrix} E & -m - i|\mathbf{p}| \\ -m + i|\mathbf{p}| & E \end{pmatrix} \rightarrow \begin{pmatrix} E & -m - i\boldsymbol{\sigma} \cdot \mathbf{p} \\ -m + i\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \text{ or } \begin{pmatrix} E & -m - i\mathbf{s} \cdot \mathbf{p} \\ -m + i\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix}, \text{ or}$$

$$\begin{aligned} \rightarrow 1 &= \frac{E^2 - \mathbf{p}_i^2}{m^2} = \left(\frac{E - |\mathbf{p}_i|}{-m} \right) \left(\frac{-m}{E + |\mathbf{p}_i|} \right)^{-1} \rightarrow \frac{E - |\mathbf{p}_i|}{-m} = \frac{-m}{E + |\mathbf{p}_i|} \rightarrow \frac{E - |\mathbf{p}_i|}{-m} - \frac{-m}{E + |\mathbf{p}_i|} = 0 \\ \rightarrow &\begin{pmatrix} E - |\mathbf{p}_i| & -m \\ -m & E + |\mathbf{p}_i| \end{pmatrix} \rightarrow \begin{pmatrix} E - \boldsymbol{\sigma} \cdot \mathbf{p}_i & -m \\ -m & E + \boldsymbol{\sigma} \cdot \mathbf{p}_i \end{pmatrix} \text{ or } \begin{pmatrix} E - \mathbf{s} \cdot \mathbf{p}_i & -m \\ -m & E + \mathbf{s} \cdot \mathbf{p}_i \end{pmatrix}, \end{aligned}$$

where $\boldsymbol{\sigma} = (\sigma_1, \sigma_2, \sigma_3)$ are Pauli matrices, $|\mathbf{p}| = \sqrt{\mathbf{p}^2} = \sqrt{-\text{Det}(\boldsymbol{\sigma} \cdot \mathbf{p})} \rightarrow \boldsymbol{\sigma} \cdot \mathbf{p}$ represents fermionic spinization of $|\mathbf{p}|$, $\mathbf{s} = (s_1, s_2, s_3)$ are spin operators for spin 1 particle, $|\mathbf{p}| = \sqrt{\mathbf{p}^2} = \sqrt{-(\text{Det}(\mathbf{s} \cdot \mathbf{p} + I_3) - \text{Det}(I_3))} \rightarrow \mathbf{s} \cdot \mathbf{p}$ represents bosonic spinization of $|\mathbf{p}|$, \mathbf{p}_i represents imaginary momentum, $|\mathbf{p}_i| = \sqrt{\mathbf{p}_i^2} = \sqrt{-\text{Det}(\boldsymbol{\sigma} \cdot \mathbf{p}_i)} \rightarrow \boldsymbol{\sigma} \cdot \mathbf{p}_i$ represents fermionic spinization of $|\mathbf{p}_i|$, and $|\mathbf{p}_i| = \sqrt{\mathbf{p}_i^2} = \sqrt{-(\text{Det}(\mathbf{s} \cdot \mathbf{p}_i + I_3) - \text{Det}(I_3))} \rightarrow \mathbf{s} \cdot \mathbf{p}_i$ represents bosonic spinization of $|\mathbf{p}_i|$;

presenting and/or modeling said second representation in said device for research, teaching and/or game.

(4) A method for presenting and/or modeling generation, sustenance and evolution of an elementary particle through hierarchical self-referential spin in prespacetime, as a research aide, teaching tool and/or game, comprising the steps of:

generating a first representation of said generation, sustenance and evolution of said elementary particle through said hierarchical self-referential spin in said prespacetime, said first representation comprising:

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

where e is natural exponential base, i is imaginary unit, L is a first phase, M is a second phase, $A_e e^{-iM} = \psi_e$ represents external object, $A_i e^{-iM} = \psi_i$ represents internal object, L_e represents external rule, L_i represents internal rule, $L = (L_{M,e} \ L_{M,i})$ represents matrix rule, $L_{M,e}$ represents external matrix rule and $L_{M,i}$ represents internal matrix rule; and

presenting and/or modeling said first representation in a device for research, teaching and/or game.

(5) A method as in (4) wherein said external object comprises of an external wave function; said internal object comprises of an internal wave function; said elementary particle comprises of a fermion, boson or unspinzied particle; said matrix rule containing an energy operator $E \rightarrow i\partial_t$, momentum operator $\mathbf{p} \rightarrow -i\nabla$, spin operator $\boldsymbol{\sigma}$ where $\boldsymbol{\sigma} = (\sigma_1, \sigma_2, \sigma_3)$ are Pauli matrices, spin operator \mathbf{S} where $\mathbf{S} = (s_1, s_2, s_3)$ are spin 1 matrices, and/or mass; said matrix rule further having a determinant containing $E^2 - \mathbf{p}^2 - m^2 = 0$, $E^2 - \mathbf{p}^2 = 0$, $E^2 - m^2 = 0$, or $0^2 - \mathbf{p}^2 - m^2 = 0$; $c=1$ where c is speed of light; and $\hbar=1$ where \hbar is reduced Planck constant.

(6) A method as (5) wherein said first representation of said generation, sustenance and evolution of said elementary particle comprises:

$$\begin{aligned}
 1 &= e^{i0} = e^{i0} e^{i0} = e^{+iL-iL} e^{+iM-iM} = (\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM} = \\
 &\left(\frac{m}{E} + i \frac{|\mathbf{p}|}{E} \right) \left(\frac{m}{E} - i \frac{|\mathbf{p}|}{E} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \left(\frac{m^2 + \mathbf{p}^2}{E^2} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \frac{E^2 - m^2}{\mathbf{p}^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \\
 &\left(\frac{E-m}{-|\mathbf{p}|} \right) \left(\frac{-|\mathbf{p}|}{E+m} \right)^{-1} \left(e^{-ip^\mu x_\mu} \right) \left(e^{-ip^\mu x_\mu} \right)^{-1} \rightarrow \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} = 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} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = 0 \quad \text{or} \\
 &\begin{pmatrix} E-m & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,+} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = 0 \\
 \text{where} &\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 \text{ is a first equation for said unspinzied} \\
 \text{particle,} &\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} = 0 \text{ is Dirac equation in Dirac form for said} \\
 \text{fermion, and} &\begin{pmatrix} E-m & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,+} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \text{ is a first equation for said boson;}
 \end{aligned}$$

$$\begin{aligned}
 1 &= e^{i0} = e^{i0} e^{i0} = e^{+iL-iL} e^{+iM-iM} = (\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM} = \\
 &\left(\frac{m}{E} + i \frac{|\mathbf{p}|}{E} \right) \left(\frac{m}{E} - i \frac{|\mathbf{p}|}{E} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \left(\frac{m^2 + \mathbf{p}^2}{E^2} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \frac{E^2 - \mathbf{p}^2}{m^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \\
 &\left(\frac{E - |\mathbf{p}|}{-m} \right) \left(\frac{-m}{E + |\mathbf{p}|} \right)^{-1} \left(e^{-ip^\mu x_\mu} \right) \left(e^{-ip^\mu x_\mu} \right)^{-1} \rightarrow \frac{E - |\mathbf{p}|}{-m} e^{-ip^\mu x_\mu} = \frac{-m}{E + |\mathbf{p}|} e^{-ip^\mu x_\mu} \rightarrow \\
 &\frac{E - |\mathbf{p}|}{-m} e^{-ip^\mu x_\mu} - \frac{-m}{E + |\mathbf{p}|} e^{-ip^\mu x_\mu} = 0 \rightarrow \begin{pmatrix} E - |\mathbf{p}| & -m \\ -m & E + |\mathbf{p}| \end{pmatrix} \begin{pmatrix} a_{e,l} e^{-ip^\mu x_\mu} \\ a_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \\
 &\rightarrow \begin{pmatrix} E - \boldsymbol{\sigma} \cdot \mathbf{p} & -m \\ -m & E + \boldsymbol{\sigma} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,l} e^{-ip^\mu x_\mu} \\ A_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = 0 \quad \text{or} \\
 &\begin{pmatrix} E - \mathbf{s} \cdot \mathbf{p} & -m \\ -m & E + \mathbf{s} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,l} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_{e,l} \\ \psi_{i,r} \end{pmatrix} = 0
 \end{aligned}$$

where $\begin{pmatrix} E - |\mathbf{p}| & -m \\ -m & E + |\mathbf{p}| \end{pmatrix} \begin{pmatrix} a_{e,l} e^{-ip^\mu x_\mu} \\ a_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a second equation for said unspinzied

particle, $\begin{pmatrix} E - \boldsymbol{\sigma} \cdot \mathbf{p} & -m \\ -m & E + \boldsymbol{\sigma} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,l} e^{-ip^\mu x_\mu} \\ A_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is Dirac equation in Weyl form for

said fermion, and $\begin{pmatrix} E - \mathbf{s} \cdot \mathbf{p} & -m \\ -m & E + \mathbf{s} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,l} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a second equation for said

boson;

$$\begin{aligned}
 1 &= e^{i0} = e^{i0} e^{i0} = e^{+iL-iL} e^{+iM-iM} = (\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM} = \\
 &\left(\frac{m}{E} + i \frac{|\mathbf{p}|}{E} \right) \left(\frac{m}{E} - i \frac{|\mathbf{p}|}{E} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \left(\frac{E}{-m + i|\mathbf{p}|} \right) \left(\frac{-m - i|\mathbf{p}|}{E} \right)^{-1} \left(e^{-ip^\mu x_\mu} \right) \left(e^{-ip^\mu x_\mu} \right)^{-1} \rightarrow \\
 &\frac{E}{-m + i|\mathbf{p}|} e^{-ip^\mu x_\mu} = \frac{-m - i|\mathbf{p}|}{E} e^{-ip^\mu x_\mu} \rightarrow \frac{E}{-m + i|\mathbf{p}|} e^{-ip^\mu x_\mu} - \frac{-m - i|\mathbf{p}|}{E} e^{-ip^\mu x_\mu} = 0 \\
 &\rightarrow \begin{pmatrix} E & -m - i|\mathbf{p}| \\ -m + i|\mathbf{p}| & E \end{pmatrix} \begin{pmatrix} a_e e^{-ip^\mu x_\mu} \\ a_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0
 \end{aligned}$$

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

$$\begin{pmatrix} E & -m - i\mathbf{s} \cdot \mathbf{p} \\ -m + i\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{-ip^\mu x_\mu} \\ \mathbf{A}_i e^{-ip^\mu x_\mu} \end{pmatrix} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0$$

where $\begin{pmatrix} E & -m - i|\mathbf{p}| \\ -m + i|\mathbf{p}| & E \end{pmatrix} \begin{pmatrix} a_e e^{-ip^\mu x_\mu} \\ a_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a third equation for said unspunized

particle, $\begin{pmatrix} E & -m - i\boldsymbol{\sigma} \cdot \mathbf{p} \\ -m + i\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{-ip^\mu x_\mu} \\ A_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is Dirac equation in a third form

for said fermion, and $\begin{pmatrix} E & -m - i\mathbf{s} \cdot \mathbf{p} \\ -m + i\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{-ip^\mu x_\mu} \\ \mathbf{A}_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a third equation

for said boson; or

$$1 = e^{i0} = e^{i0} e^{i0} = e^{+iL-iL} e^{+iM-iM} = (\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM} =$$

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

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

$$\frac{E-m}{-|\mathbf{p}_i|} e^{-ip^\mu x_\mu} - \frac{-|\mathbf{p}_i|}{E+m} e^{-ip^\mu x_\mu} = 0 \rightarrow \begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0$$

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

$$\begin{pmatrix} E-m & -\mathbf{s} \cdot \mathbf{p}_i \\ -\mathbf{s} \cdot \mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} \mathbf{S}_{e,+} e^{-iEt} \\ \mathbf{S}_{i,-} e^{-iEt} \end{pmatrix} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = 0$$

where $\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0$ is a first equation for said unspunized particle

with said imaginary momentum \mathbf{p}_i , $\begin{pmatrix} E-m & -\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -\boldsymbol{\sigma} \cdot \mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0$ is Dirac equation

in Dirac form for said fermion with said imaginary momentum \mathbf{p}_i , and

$\begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p}_i \\ -\mathbf{s}\cdot\mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} \mathbf{S}_{e,+} e^{-iEt} \\ \mathbf{S}_{i,-} e^{-iEt} \end{pmatrix} = 0$ is a first equation for said boson with said imaginary momentum \mathbf{p}_i .

(7) A method as in (6) wherein said elementary particle comprises of:

an electron, equation of said electron being modeled as:

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} A_{e,+} e^{-ip^\mu x_\mu} \\ A_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0, \begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p} & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,l} e^{-ip^\mu x_\mu} \\ A_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{-ip^\mu x_\mu} \\ A_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0;$$

a positron, equation of said positron being modeled as:

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} A_{e,-} e^{+ip^\mu x_\mu} \\ A_{i,+} e^{+ip^\mu x_\mu} \end{pmatrix} = 0, \begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p} & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,r} e^{+ip^\mu x_\mu} \\ A_{i,l} e^{+ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{+ip^\mu x_\mu} \\ A_i e^{+ip^\mu x_\mu} \end{pmatrix} = 0;$$

a massless neutrino, equation of said neutrino being modeled as:

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_{e,+} e^{-ip^\mu x_\mu} \\ A_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0, \begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p} & \\ & E+\boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,l} e^{-ip^\mu x_\mu} \\ A_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -i\boldsymbol{\sigma}\cdot\mathbf{p} \\ +i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{-ip^\mu x_\mu} \\ A_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0;$$

A massless antineutrino, equation of said antineutrino being modeled as:

$$\begin{pmatrix} E & -\boldsymbol{\sigma}\cdot\mathbf{p} \\ -\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_{e,-} e^{+ip^\mu x_\mu} \\ A_{i,+} e^{+ip^\mu x_\mu} \end{pmatrix} = 0, \begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p} & \\ & E+\boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,r} e^{+ip^\mu x_\mu} \\ A_{i,l} e^{+ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -i\boldsymbol{\sigma}\cdot\mathbf{p} \\ +i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{+ip^\mu x_\mu} \\ A_i e^{+ip^\mu x_\mu} \end{pmatrix} = 0;$$

a massive spin 1 boson, equation of said massive spin 1 boson being modeled as:

$$\begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,+} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E-\mathbf{s}\cdot\mathbf{p} & -m \\ -m & E+\mathbf{s}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,l} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m-i\mathbf{s}\cdot\mathbf{p} \\ -m+i\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{-ip^\mu x_\mu} \\ \mathbf{A}_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0;$$

a massive spin 1 antiboson, equation of said massive spin 1 antiboson being modeled as:

$$\begin{pmatrix} E-m & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,-} e^{+ip^\mu x_\mu} \\ \mathbf{A}_{i,+} e^{+ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E-\mathbf{s}\cdot\mathbf{p} & -m \\ -m & E+\mathbf{s}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,r} e^{+ip^\mu x_\mu} \\ \mathbf{A}_{i,l} e^{+ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m-i\mathbf{s}\cdot\mathbf{p} \\ -m+i\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{+ip^\mu x_\mu} \\ \mathbf{A}_i e^{+ip^\mu x_\mu} \end{pmatrix} = 0;$$

a massless spin 1 boson, equation of said massless spin 1 boson being modeled as:

$$\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,+} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = \begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{E} \\ i\mathbf{B} \end{pmatrix} = 0,$$

$$\begin{pmatrix} E-\mathbf{s}\cdot\mathbf{p} & \\ & E+\mathbf{s}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,l} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or } \begin{pmatrix} E & -i\mathbf{s}\cdot\mathbf{p} \\ +i\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{-ip^\mu x_\mu} \\ \mathbf{A}_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$$

where $\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{E} \\ i\mathbf{B} \end{pmatrix} = 0$ is equivalent to Maxwell equation $\begin{pmatrix} \partial_t \mathbf{E} = \nabla \times \mathbf{B} \\ \partial_t \mathbf{B} = -\nabla \times \mathbf{E} \end{pmatrix}$;

a massless spin 1 antiboson, equation of said massless spin 1 antiboson being modeled as:

$$\begin{pmatrix} E & -\mathbf{s}\cdot\mathbf{p} \\ -\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,-} e^{+ip^\mu x_\mu} \\ \mathbf{A}_{i,+} e^{+ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E-\mathbf{s}\cdot\mathbf{p} & \\ & E+\mathbf{s}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,r} e^{+ip^\mu x_\mu} \\ \mathbf{A}_{i,l} e^{+ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -i\mathbf{s}\cdot\mathbf{p} \\ -m+i\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{+ip^\mu x_\mu} \\ \mathbf{A}_i e^{+ip^\mu x_\mu} \end{pmatrix} = 0;$$

an antiproton, equation of said antiproton being modeled as:

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma}\cdot\mathbf{p}_i \\ -\boldsymbol{\sigma}\cdot\mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0, \quad \begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p}_i \end{pmatrix} \begin{pmatrix} S_{e,l} e^{-iEt} \\ S_{i,r} e^{-iEt} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p}_i \\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p}_i & E \end{pmatrix} \begin{pmatrix} S_e e^{-iEt} \\ S_i e^{-iEt} \end{pmatrix} = 0; \text{ or}$$

a proton, equation of said proton being modeled as:

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -\boldsymbol{\sigma} \cdot \mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} S_{e,-} e^{+iEt} \\ S_{i,+} e^{+iEt} \end{pmatrix} = 0, \quad \begin{pmatrix} E-\boldsymbol{\sigma} \cdot \mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma} \cdot \mathbf{p}_i \end{pmatrix} \begin{pmatrix} S_{e,r} e^{+iEt} \\ S_{i,l} e^{+iEt} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m-i\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -m+i\boldsymbol{\sigma} \cdot \mathbf{p}_i & E \end{pmatrix} \begin{pmatrix} S_e e^{+iEt} \\ S_i e^{+iEt} \end{pmatrix} = 0.$$

(8) A method as in (6) wherein said elementary particle comprises an electron and said first representation is modified to include a proton, said proton being modeled as a second elementary particle, and interaction fields of said electron and said proton, said modified first representation comprising:

$$\begin{aligned} 1 &= e^{i0} = e^{i0} e^{i0} e^{i0} e^{i0} = (e^{i0} e^{i0})_p (e^{i0} e^{i0})_e = (e^{+iL-iM} e^{+iM-iM})_p (e^{-iL+iL} e^{-iM+iM})_e \\ &= ((\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM})_p ((\cos L - i \sin L)(\cos L + i \sin L) e^{-iM+iM})_e \\ &= \left(\left(\frac{m}{E} + i \frac{|\mathbf{p}_i|}{E} \right) \left(\frac{m}{E} - i \frac{|\mathbf{p}_i|}{E} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\left(\frac{m}{E} - i \frac{|\mathbf{p}|}{E} \right) \left(\frac{m}{E} + i \frac{|\mathbf{p}|}{E} \right) e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e \\ &= \left(\frac{m^2 + \mathbf{p}_i^2}{E^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\frac{m^2 + \mathbf{p}^2}{E^2} e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e \\ &= \left(\frac{E^2 - m^2}{\mathbf{p}_i^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\frac{E^2 - m^2}{\mathbf{p}^2} e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e = \\ &= \left(\left(\frac{E-m}{-|\mathbf{p}_i|} \right) \left(\frac{-|\mathbf{p}_i|}{E+m} \right)^{-1} \left(e^{+ip^\mu x_\mu} \right) \left(e^{+ip^\mu x_\mu} \right)^{-1} \right)_p \left(\left(\frac{E-m}{-|\mathbf{p}|} \right) \left(\frac{-|\mathbf{p}|}{E+m} \right)^{-1} \left(e^{-ip^\mu x_\mu} \right) \left(e^{-ip^\mu x_\mu} \right)^{-1} \right)_e \\ &\rightarrow \left(\left(\frac{E-m}{-|\mathbf{p}_i|} \right) \left(\frac{-|\mathbf{p}_i|}{E+m} \right) \begin{pmatrix} s_{e,-} e^{+iEt} \\ s_{i,+} e^{+iEt} \end{pmatrix} = 0 \right)_p \left(\left(\frac{E-m}{-|\mathbf{p}|} \right) \left(\frac{-|\mathbf{p}|}{E+m} \right) \begin{pmatrix} s_{e,+} e^{-iEt} \\ s_{i,-} e^{-iEt} \end{pmatrix} = 0 \right)_e \\ &\rightarrow \left(\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 \right. \\ &\quad \left. \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 \right) \end{aligned}$$

where $()_e$ denotes electron, $()_p$ denotes proton and $(()_e ()_p)$ denotes an electron-proton system.

(9) A method as in (6) wherein said elementary particle comprises an electron and said first representation is modified to include a unspinned proton, said unspinned proton being modeled as a second elementary particle, and interaction fields of said electron and said unspinned proton, said modified first representation comprising:

$$\begin{aligned}
 1 &= e^{i0} = e^{i0} e^{i0} e^{i0} e^{i0} = \left(e^{i0} e^{i0} \right)_p \left(e^{i0} e^{i0} \right)_e = \left(e^{+iL-iM} e^{+iM-iM} \right)_p \left(e^{-iL+iL} e^{-iM+iM} \right)_e \\
 &= \left((\cos L + i \sin L) (\cos L - i \sin L) e^{+iM-iM} \right)_p \left((\cos L - i \sin L) (\cos L + i \sin L) e^{-iM+iM} \right)_e \\
 &= \left(\left(\frac{m}{E} + i \frac{|\mathbf{p}_i|}{E} \right) \left(\frac{m}{E} - i \frac{|\mathbf{p}_i|}{E} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\left(\frac{m}{E} - i \frac{|\mathbf{p}|}{E} \right) \left(\frac{m}{E} + i \frac{|\mathbf{p}|}{E} \right) e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e \\
 &= \left(\frac{m^2 + \mathbf{p}_i^2}{E^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\frac{m^2 + \mathbf{p}^2}{E^2} e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e \\
 &= \left(\frac{E^2 - m^2}{\mathbf{p}_i^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\frac{E^2 - m^2}{\mathbf{p}^2} e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e = \\
 &\left(\left(\frac{E-m}{-|\mathbf{p}_i|} \right) \left(\frac{-|\mathbf{p}_i|}{E+m} \right)^{-1} \left(e^{+ip^\mu x_\mu} \right) \left(e^{+ip^\mu x_\mu} \right)^{-1} \right)_p \left(\left(\frac{E-m}{-|\mathbf{p}|} \right) \left(\frac{-|\mathbf{p}|}{E+m} \right)^{-1} \left(e^{-ip^\mu x_\mu} \right) \left(e^{-ip^\mu x_\mu} \right)^{-1} \right)_e \\
 &\rightarrow \left(\left(\begin{array}{cc} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{array} \right) \left(\begin{array}{c} s_{e,-} e^{+iEt} \\ s_{i,+} e^{+iEt} \end{array} \right) = 0 \right)_p \left(\left(\begin{array}{cc} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{array} \right) \left(\begin{array}{c} s_{e,+} e^{-iEt} \\ s_{i,-} e^{-iEt} \end{array} \right) = 0 \right)_e \\
 &\rightarrow \left(\left(\begin{array}{cc} E-e\phi-m & -|\mathbf{p}_i-e\mathbf{A}| \\ -|\mathbf{p}_i-e\mathbf{A}| & E-e\phi+m \end{array} \right) \left(\begin{array}{c} s_{e,-} e^{+iEt} \\ s_{i,+} e^{+iEt} \end{array} \right) = 0 \right)_p \\
 &\left(\left(\begin{array}{cc} 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{array} \right) \left(\begin{array}{c} s_{e,+} e^{-iEt} \\ s_{i,-} e^{-iEt} \end{array} \right) = 0 \right)_e
 \end{aligned}$$

where $()_e$ denotes electron, $()_p$ denotes unspinned proton and $(()_e ()_p)$ denotes an electron-unspinned proton system.

II. Modeling Apparatus Based on Prespacetime Model II

(10) A model for presenting and/or modeling generation of an energy-momentum-mass relationship of an elementary particle through hierarchical self-referential spin in prespacetime, as a research aide, teaching tool and/or game, comprising:

a first drawing which represents said spin producing said energy-momentum-mass relationship of said elementary particle through said hierarchical self-referential spin in said prespacetime, said first drawing comprising:

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

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

where e is natural exponential base, i is imaginary unit, L is a phase, E , m and \mathbf{p} represent respectively energy, mass and momentum of said elementary particle, and speed of light c is set equal to one; and

a device for presenting and/or modeling said drawing, said device being for research, teaching and/or game.

(11) A model as in (10) wherein said first drawing is modified to include an electromagnetic potential (\mathbf{A}, ϕ) generated by a second elementary particle, said modified drawing comprising:

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

$$\left(\frac{m}{E - e\phi} - i \frac{|\mathbf{p} - e\mathbf{A}|}{E - e\phi} \right) \left(\frac{m}{E - e\phi} + i \frac{|\mathbf{p} - e\mathbf{A}|}{E - e\phi} \right) =$$

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

where e next to ϕ or \mathbf{A} is electric charge of said elementary particle.

(12) A model as in (10) for presenting and/or modeling generation of a self-referential matrix rule further comprising:

a second drawing which represents said spin forming said matrix rule from said energy-momentum-mass relationship, said second drawing comprising:

$$\begin{aligned} \rightarrow 1 &= \frac{E^2 - m^2}{\mathbf{p}^2} = \left(\frac{E-m}{-|\mathbf{p}|} \right) \left(\frac{-|\mathbf{p}|}{E+m} \right)^{-1} \rightarrow \frac{E-m}{-|\mathbf{p}|} = \frac{-|\mathbf{p}|}{E+m} \rightarrow \frac{E-m}{-|\mathbf{p}|} - \frac{-|\mathbf{p}|}{E+m} = 0 \\ &\rightarrow \begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} \rightarrow \begin{pmatrix} E-m & -\boldsymbol{\sigma} \cdot \mathbf{p} \\ -\boldsymbol{\sigma} \cdot \mathbf{p} & E+m \end{pmatrix} \text{ or } \begin{pmatrix} E-m & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E+m \end{pmatrix}, \\ \rightarrow 1 &= \frac{E^2 - \mathbf{p}^2}{m^2} = \left(\frac{E-|\mathbf{p}|}{-m} \right) \left(\frac{-m}{E+|\mathbf{p}|} \right)^{-1} \rightarrow \frac{E-|\mathbf{p}|}{-m} = \frac{-m}{E+|\mathbf{p}|} \rightarrow \frac{E-|\mathbf{p}|}{-m} - \frac{-m}{E+|\mathbf{p}|} = 0 \\ &\rightarrow \begin{pmatrix} E-|\mathbf{p}| & -m \\ -m & E+|\mathbf{p}| \end{pmatrix} \rightarrow \begin{pmatrix} E-\boldsymbol{\sigma} \cdot \mathbf{p} & -m \\ -m & E+\boldsymbol{\sigma} \cdot \mathbf{p} \end{pmatrix} \text{ or } \begin{pmatrix} E-\mathbf{s} \cdot \mathbf{p} & -m \\ -m & E+\mathbf{s} \cdot \mathbf{p} \end{pmatrix}, \\ \rightarrow 1 &= \frac{m^2 + \mathbf{p}^2}{E^2} = \left(\frac{E}{-m+i|\mathbf{p}|} \right)^{-1} \left(\frac{-m-i|\mathbf{p}|}{E} \right) \\ &\rightarrow \frac{E}{-m+i|\mathbf{p}|} = \frac{-m-i|\mathbf{p}|}{E} \rightarrow \frac{E}{-m+i|\mathbf{p}|} - \frac{-m-i|\mathbf{p}|}{E} = 0 \\ &\rightarrow \begin{pmatrix} E & -m-i|\mathbf{p}| \\ -m+i|\mathbf{p}| & E \end{pmatrix} \rightarrow \begin{pmatrix} E & -m-i\boldsymbol{\sigma} \cdot \mathbf{p} \\ -m+i\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \text{ or } \begin{pmatrix} E & -m-i\mathbf{s} \cdot \mathbf{p} \\ -m+i\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix}, \text{ or} \\ \rightarrow 1 &= \frac{E^2 - \mathbf{p}_i^2}{m^2} = \left(\frac{E-|\mathbf{p}_i|}{-m} \right) \left(\frac{-m}{E+|\mathbf{p}_i|} \right)^{-1} \rightarrow \frac{E-|\mathbf{p}_i|}{-m} = \frac{-m}{E+|\mathbf{p}_i|} \rightarrow \frac{E-|\mathbf{p}_i|}{-m} - \frac{-m}{E+|\mathbf{p}_i|} = 0 \\ &\rightarrow \begin{pmatrix} E-|\mathbf{p}_i| & -m \\ -m & E+|\mathbf{p}_i| \end{pmatrix} \rightarrow \begin{pmatrix} E-\boldsymbol{\sigma} \cdot \mathbf{p}_i & -m \\ -m & E+\boldsymbol{\sigma} \cdot \mathbf{p}_i \end{pmatrix} \text{ or } \begin{pmatrix} E-\mathbf{s} \cdot \mathbf{p}_i & -m \\ -m & E+\mathbf{s} \cdot \mathbf{p}_i \end{pmatrix}, \end{aligned}$$

where $\boldsymbol{\sigma} = (\sigma_1, \sigma_2, \sigma_3)$ are Pauli matrices, $|\mathbf{p}| = \sqrt{\mathbf{p}^2} = \sqrt{-\text{Det}(\boldsymbol{\sigma} \cdot \mathbf{p})} \rightarrow \boldsymbol{\sigma} \cdot \mathbf{p}$ represents fermionic spinization of $|\mathbf{p}|$, $\mathbf{s} = (s_1, s_2, s_3)$ are spin operators for spin 1 particle, $|\mathbf{p}| = \sqrt{\mathbf{p}^2} = \sqrt{-(\text{Det}(\mathbf{s} \cdot \mathbf{p} + I_3) - \text{Det}(I_3))} \rightarrow \mathbf{s} \cdot \mathbf{p}$ represents bosonic spinization of $|\mathbf{p}|$, \mathbf{p}_i represents imaginary momentum, $|\mathbf{p}_i| = \sqrt{\mathbf{p}_i^2} = \sqrt{-\text{Det}(\boldsymbol{\sigma} \cdot \mathbf{p}_i)} \rightarrow \boldsymbol{\sigma} \cdot \mathbf{p}_i$ represents fermionic spinization of $|\mathbf{p}_i|$, and $|\mathbf{p}_i| = \sqrt{\mathbf{p}_i^2} = \sqrt{-(\text{Det}(\mathbf{s} \cdot \mathbf{p}_i + I_3) - \text{Det}(I_3))} \rightarrow \mathbf{s} \cdot \mathbf{p}_i$ represents bosonic spinization of $|\mathbf{p}_i|$.

(13) A model for presenting and/or modeling generation, sustenance and evolution of an elementary particle through hierarchical self-referential spin in prespacetime, as a research aide, teaching tool and/or game, comprising:

a drawing which represents said generation, sustenance and evolution of said elementary

particle through said hierarchical self-referential spin in said prespacetime, said drawing comprising:

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

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

where e is natural exponential base, i is imaginary unit, L is a first phase, M is a second phase, $A_e e^{-iM} = \psi_e$ represents external object, $A_i e^{-iM} = \psi_i$ represents internal object, L_e represents external rule, L_i represents internal rule, $L = (L_{M,e} \ L_{M,i})$ represents matrix rule, $L_{M,e}$ represents external matrix rule and $L_{M,i}$ represents internal matrix rule; and

a device for presenting and/or modeling said drawing, said device being for research, teaching and/or game.

(14) A model as in (13) wherein said external object comprises of an external wave function; said internal object comprises of an internal wave function; said elementary particle comprises of a fermion, boson or unspinned particle; said matrix rule containing an energy operator $E \rightarrow i\partial_t$, momentum operator $\mathbf{p} \rightarrow -i\nabla$, spin operator $\boldsymbol{\sigma}$ where $\boldsymbol{\sigma} = (\sigma_1, \sigma_2, \sigma_3)$ are Pauli matrices, spin operator \mathbf{S} where $\mathbf{S} = (s_1, s_2, s_3)$ are spin 1 matrices, and/or mass; said matrix rule further having a determinant containing $E^2 - \mathbf{p}^2 - m^2 = 0$, $E^2 - \mathbf{p}^2 = 0$, $E^2 - m^2 = 0$, or $0^2 - \mathbf{p}^2 - m^2 = 0$; $c=1$ where c is speed of light; and $\hbar=1$ where \hbar is reduced Planck constant.

(15) A model as in Claim 14 wherein said drawing of said generation, sustenance and evolution of said elementary particle comprises:

$$1 = e^{i0} = e^{i0} e^{i0} = e^{+iL-iL} e^{+iM-iM} = (\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM} =$$

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

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

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

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

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

where $\begin{pmatrix} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{pmatrix} \begin{pmatrix} a_{e,+} e^{-ip^\mu x_\mu} \\ a_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a first equation for said unspinzed

particle, $\begin{pmatrix} E-m & -\boldsymbol{\sigma} \cdot \mathbf{p} \\ -\boldsymbol{\sigma} \cdot \mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} A_{e,+} e^{-ip^\mu x_\mu} \\ A_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is Dirac equation in Dirac form for said

fermion, and $\begin{pmatrix} E-m & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,+} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a first equation for said boson;

$$1 = e^{i0} = e^{i0} e^{i0} = e^{+iL-iL} e^{+iM-iM} = (\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM} =$$

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

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

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

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

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

where $\begin{pmatrix} E-|\mathbf{p}| & -m \\ -m & E+|\mathbf{p}| \end{pmatrix} \begin{pmatrix} a_{e,l} e^{-ip^\mu x_\mu} \\ a_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a second equation for said unspinzied

particle, $\begin{pmatrix} E-\boldsymbol{\sigma}\cdot\mathbf{p} & -m \\ -m & E+\boldsymbol{\sigma}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,l} e^{-ip^\mu x_\mu} \\ A_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is Dirac equation in Weyl form for

said fermion, and $\begin{pmatrix} E-\mathbf{s}\cdot\mathbf{p} & -m \\ -m & E+\mathbf{s}\cdot\mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,l} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a second equation for said

boson;

$$1 = e^{i0} = e^{i0} e^{i0} = e^{+iL-iL} e^{+iM-iM} = (\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM} =$$

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

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

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

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

$$\begin{pmatrix} E & -m-i\mathbf{s}\cdot\mathbf{p} \\ -m+i\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{-ip^\mu x_\mu} \\ \mathbf{A}_i e^{-ip^\mu x_\mu} \end{pmatrix} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_e \\ \psi_i \end{pmatrix} = 0$$

where $\begin{pmatrix} E & -m-i|\mathbf{p}| \\ -m+i|\mathbf{p}| & E \end{pmatrix} \begin{pmatrix} a_e e^{-ip^\mu x_\mu} \\ a_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a third equation for said unspinzied

particle, $\begin{pmatrix} E & -m-i\boldsymbol{\sigma}\cdot\mathbf{p} \\ -m+i\boldsymbol{\sigma}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{-ip^\mu x_\mu} \\ A_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is Dirac equation in a third form

for said fermion, and $\begin{pmatrix} E & -m-i\mathbf{s}\cdot\mathbf{p} \\ -m+i\mathbf{s}\cdot\mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{-ip^\mu x_\mu} \\ \mathbf{A}_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$ is a third equation

for said boson; or

$$\begin{aligned}
 1 &= e^{i0} = e^{i0} e^{i0} = e^{+iL-iL} e^{+iM-iM} = (\cos L + i \sin L)(\cos L - i \sin L) e^{+iM-iM} = \\
 &\left(\frac{m}{E} + i \frac{|\mathbf{p}_i|}{E} \right) \left(\frac{m}{E} - i \frac{|\mathbf{p}_i|}{E} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \left(\frac{m^2 + \mathbf{p}_i^2}{E^2} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \frac{E^2 - m^2}{\mathbf{p}_i^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} = \\
 &\left(\frac{E-m}{-|\mathbf{p}_i|} \right) \left(\frac{-|\mathbf{p}_i|}{E+m} \right)^{-1} \left(e^{-ip^\mu x_\mu} \right) \left(e^{-ip^\mu x_\mu} \right)^{-1} \rightarrow \frac{E-m}{-|\mathbf{p}_i|} e^{-ip^\mu x_\mu} = \frac{-|\mathbf{p}_i|}{E+m} e^{-ip^\mu x_\mu} \rightarrow \\
 &\frac{E-m}{-|\mathbf{p}_i|} e^{-ip^\mu x_\mu} - \frac{-|\mathbf{p}_i|}{E+m} e^{-ip^\mu x_\mu} = 0 \rightarrow \begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0 \\
 &\rightarrow \begin{pmatrix} E-m & -\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -\boldsymbol{\sigma} \cdot \mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = 0 \quad \text{or} \\
 &\begin{pmatrix} E-m & -\mathbf{s} \cdot \mathbf{p}_i \\ -\mathbf{s} \cdot \mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = (L_{M,e} \quad L_{M,i}) \begin{pmatrix} \psi_{e,+} \\ \psi_{i,-} \end{pmatrix} = 0
 \end{aligned}$$

where $\begin{pmatrix} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0$ is a first equation for said unspunized particle

with said imaginary momentum \mathbf{p}_i , $\begin{pmatrix} E-m & -\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -\boldsymbol{\sigma} \cdot \mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0$ is Dirac equation

in Dirac form for said fermion with said imaginary momentum \mathbf{p}_i , and

$\begin{pmatrix} E-m & -\mathbf{s} \cdot \mathbf{p}_i \\ -\mathbf{s} \cdot \mathbf{p}_i & E+m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0$ is a first equation for said boson with said imaginary momentum \mathbf{p}_i .

(16) A model as in (15) wherein said elementary particle comprises of:

an electron, equation of said electron being modeled as:

$$\begin{aligned}
 &\begin{pmatrix} E-m & -\boldsymbol{\sigma} \cdot \mathbf{p} \\ -\boldsymbol{\sigma} \cdot \mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} A_{e,+} e^{-ip^\mu x_\mu} \\ A_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E-\boldsymbol{\sigma} \cdot \mathbf{p} & -m \\ -m & E+\boldsymbol{\sigma} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,l} e^{-ip^\mu x_\mu} \\ A_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \quad \text{or} \\
 &\begin{pmatrix} E & -m-i\boldsymbol{\sigma} \cdot \mathbf{p} \\ -m+i\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{-ip^\mu x_\mu} \\ A_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0;
 \end{aligned}$$

a positron, equation of said positron being modeled as:

$$\begin{pmatrix} E-m & -\boldsymbol{\sigma} \cdot \mathbf{p} \\ -\boldsymbol{\sigma} \cdot \mathbf{p} & E+m \end{pmatrix} \begin{pmatrix} A_{e,-} e^{+ip^\mu x_\mu} \\ A_{i,+} e^{+ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E-\boldsymbol{\sigma} \cdot \mathbf{p} & -m \\ -m & E+\boldsymbol{\sigma} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,r} e^{+ip^\mu x_\mu} \\ A_{i,l} e^{+ip^\mu x_\mu} \end{pmatrix} = 0 \quad \text{or}$$

$$\begin{pmatrix} E & -m - i\boldsymbol{\sigma} \cdot \mathbf{p} \\ -m + i\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{+ip^\mu x_\mu} \\ A_i e^{+ip^\mu x_\mu} \end{pmatrix} = 0;$$

a massless neutrino, equation of said neutrino being modeled as:

$$\begin{pmatrix} E & -\boldsymbol{\sigma} \cdot \mathbf{p} \\ -\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_{e,+} e^{-ip^\mu x_\mu} \\ A_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E - \boldsymbol{\sigma} \cdot \mathbf{p} & \\ & E + \boldsymbol{\sigma} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,l} e^{-ip^\mu x_\mu} \\ A_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -i\boldsymbol{\sigma} \cdot \mathbf{p} \\ +i\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{-ip^\mu x_\mu} \\ A_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0;$$

A massless antineutrino, equation of said antineutrino being modeled as:

$$\begin{pmatrix} E & -\boldsymbol{\sigma} \cdot \mathbf{p} \\ -\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_{e,-} e^{+ip^\mu x_\mu} \\ A_{i,+} e^{+ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E - \boldsymbol{\sigma} \cdot \mathbf{p} & \\ & E + \boldsymbol{\sigma} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,r} e^{+ip^\mu x_\mu} \\ A_{i,l} e^{+ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -i\boldsymbol{\sigma} \cdot \mathbf{p} \\ +i\boldsymbol{\sigma} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{+ip^\mu x_\mu} \\ A_i e^{+ip^\mu x_\mu} \end{pmatrix} = 0;$$

a massive spin 1 boson, equation of said massive spin 1 boson being modeled as:

$$\begin{pmatrix} E - m & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E + m \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,+} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E - \mathbf{s} \cdot \mathbf{p} & -m \\ -m & E + \mathbf{s} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,l} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m - i\mathbf{s} \cdot \mathbf{p} \\ -m + i\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{-ip^\mu x_\mu} \\ \mathbf{A}_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0;$$

a massive spin 1 antiboson, equation of said massive spin 1 antiboson being modeled as:

$$\begin{pmatrix} E - m & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E + m \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,-} e^{+ip^\mu x_\mu} \\ \mathbf{A}_{i,+} e^{+ip^\mu x_\mu} \end{pmatrix} = 0, \quad \begin{pmatrix} E - \mathbf{s} \cdot \mathbf{p} & -m \\ -m & E + \mathbf{s} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,r} e^{+ip^\mu x_\mu} \\ \mathbf{A}_{i,l} e^{+ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m - i\mathbf{s} \cdot \mathbf{p} \\ -m + i\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{+ip^\mu x_\mu} \\ \mathbf{A}_i e^{+ip^\mu x_\mu} \end{pmatrix} = 0;$$

a massless spin 1 boson, equation of said massless spin 1 boson being modeled as:

$$\begin{pmatrix} E & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,+} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,-} e^{-ip^\mu x_\mu} \end{pmatrix} = \begin{pmatrix} E & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{E} \\ i\mathbf{B} \end{pmatrix} = 0,$$

$$\begin{pmatrix} E - \mathbf{s} \cdot \mathbf{p} & \\ & E + \mathbf{s} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} \mathbf{A}_{e,l} e^{-ip^\mu x_\mu} \\ \mathbf{A}_{i,r} e^{-ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or } \begin{pmatrix} E & -i\mathbf{s} \cdot \mathbf{p} \\ +i\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{A}_e e^{-ip^\mu x_\mu} \\ \mathbf{A}_i e^{-ip^\mu x_\mu} \end{pmatrix} = 0$$

where $\begin{pmatrix} E & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} \mathbf{E} \\ i\mathbf{B} \end{pmatrix} = 0$ is equivalent to Maxwell equation $\begin{pmatrix} \partial_i \mathbf{E} = \nabla \times \mathbf{B} \\ \partial_i \mathbf{B} = -\nabla \times \mathbf{E} \end{pmatrix}$;

a massless spin 1 antiposon, equation of said massless spin 1 antiposon being modeled as:

$$\begin{pmatrix} E & -\mathbf{s} \cdot \mathbf{p} \\ -\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_{e,-} e^{+ip^\mu x_\mu} \\ A_{i,+} e^{+ip^\mu x_\mu} \end{pmatrix} = 0, \begin{pmatrix} E - \mathbf{s} \cdot \mathbf{p} & \\ & E + \mathbf{s} \cdot \mathbf{p} \end{pmatrix} \begin{pmatrix} A_{e,r} e^{+ip^\mu x_\mu} \\ A_{i,l} e^{+ip^\mu x_\mu} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -i\mathbf{s} \cdot \mathbf{p} \\ -m + i\mathbf{s} \cdot \mathbf{p} & E \end{pmatrix} \begin{pmatrix} A_e e^{+ip^\mu x_\mu} \\ A_i e^{+ip^\mu x_\mu} \end{pmatrix} = 0;$$

an antiproton, equation of said antiproton being modeled as:

$$\begin{pmatrix} E - m & -\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -\boldsymbol{\sigma} \cdot \mathbf{p}_i & E + m \end{pmatrix} \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0, \begin{pmatrix} E - \boldsymbol{\sigma} \cdot \mathbf{p}_i & -m \\ -m & E + \boldsymbol{\sigma} \cdot \mathbf{p}_i \end{pmatrix} \begin{pmatrix} S_{e,l} e^{-iEt} \\ S_{i,r} e^{-iEt} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m - i\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -m + i\boldsymbol{\sigma} \cdot \mathbf{p}_i & E \end{pmatrix} \begin{pmatrix} S_e e^{-iEt} \\ S_i e^{-iEt} \end{pmatrix} = 0; \text{ or}$$

a proton, equation of said proton being modeled as:

$$\begin{pmatrix} E - m & -\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -\boldsymbol{\sigma} \cdot \mathbf{p}_i & E + m \end{pmatrix} \begin{pmatrix} S_{e,-} e^{+iEt} \\ S_{i,+} e^{+iEt} \end{pmatrix} = 0, \begin{pmatrix} E - \boldsymbol{\sigma} \cdot \mathbf{p}_i & -m \\ -m & E + \boldsymbol{\sigma} \cdot \mathbf{p}_i \end{pmatrix} \begin{pmatrix} S_{e,r} e^{+iEt} \\ S_{i,l} e^{+iEt} \end{pmatrix} = 0 \text{ or}$$

$$\begin{pmatrix} E & -m - i\boldsymbol{\sigma} \cdot \mathbf{p}_i \\ -m + i\boldsymbol{\sigma} \cdot \mathbf{p}_i & E \end{pmatrix} \begin{pmatrix} S_e e^{+iEt} \\ S_i e^{+iEt} \end{pmatrix} = 0.$$

(17) A model as in (15) wherein said elementary particle comprises an electron and said drawing is modified to include a proton, said proton being modeled as a second elementary particle, and interaction fields of said electron and said proton, said modified drawing comprising:

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

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

$$\begin{aligned}
 &= \left(\left(\frac{m}{E} + i \frac{|\mathbf{p}_i|}{E} \right) \left(\frac{m}{E} - i \frac{|\mathbf{p}_i|}{E} \right) e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\left(\frac{m}{E} - i \frac{|\mathbf{p}|}{E} \right) \left(\frac{m}{E} + i \frac{|\mathbf{p}|}{E} \right) e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e \\
 &= \left(\frac{m^2 + \mathbf{p}_i^2}{E^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\frac{m^2 + \mathbf{p}^2}{E^2} e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e \\
 &= \left(\frac{E^2 - m^2}{\mathbf{p}_i^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\frac{E^2 - m^2}{\mathbf{p}^2} e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e = \\
 &\left(\left(\frac{E-m}{-|\mathbf{p}_i|} \right) \left(\frac{-|\mathbf{p}_i|}{E+m} \right)^{-1} \left(e^{+ip^\mu x_\mu} \right) \left(e^{+ip^\mu x_\mu} \right)^{-1} \right)_p \left(\left(\frac{E-m}{-|\mathbf{p}|} \right) \left(\frac{-|\mathbf{p}|}{E+m} \right)^{-1} \left(e^{-ip^\mu x_\mu} \right) \left(e^{-ip^\mu x_\mu} \right)^{-1} \right)_e \\
 &\rightarrow \left(\left(\begin{array}{cc} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{array} \right) \begin{pmatrix} s_{e,-} e^{+iEt} \\ s_{i,+} e^{+iEt} \end{pmatrix} = 0 \right)_p \left(\left(\begin{array}{cc} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{array} \right) \begin{pmatrix} s_{e,+} e^{-iEt} \\ s_{i,-} e^{-iEt} \end{pmatrix} = 0 \right)_e \\
 &\rightarrow \left(\left(\begin{array}{cc} E-e\phi-m & -\boldsymbol{\sigma} \cdot (\mathbf{p}_i - e\mathbf{A}) \\ -\boldsymbol{\sigma} \cdot (\mathbf{p}_i - e\mathbf{A}) & E-e\phi+m \end{array} \right) \begin{pmatrix} S_{e,-} e^{+iEt} \\ S_{i,+} e^{+iEt} \end{pmatrix} = 0 \right)_p \\
 &\left(\left(\begin{array}{cc} E+e\phi-m & -\boldsymbol{\sigma} \cdot (\mathbf{p} + e\mathbf{A}) \\ -\boldsymbol{\sigma} \cdot (\mathbf{p} + e\mathbf{A}) & E+e\phi+m \end{array} \right) \begin{pmatrix} S_{e,+} e^{-iEt} \\ S_{i,-} e^{-iEt} \end{pmatrix} = 0 \right)_e
 \end{aligned}$$

where $()_e$ denotes electron, $()_p$ denotes proton and $(()_e ()_p)$ denotes an electron-proton system.

(18) A model as in (15) wherein said elementary particle comprises an electron and said drawing is modified to include a unspinned proton, said unspinned proton being modeled as a second elementary particle, and interaction fields of said electron and said unspinned proton, said modified drawing comprising:

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

$$\begin{aligned}
 &= \left(\frac{E^2 - m^2}{\mathbf{p}_i^2} e^{+ip^\mu x_\mu - ip^\mu x_\mu} \right)_p \left(\frac{E^2 - m^2}{\mathbf{p}^2} e^{-ip^\mu x_\mu + ip^\mu x_\mu} \right)_e = \\
 &\left(\left(\frac{E-m}{-|\mathbf{p}_i|} \right) \left(\frac{-|\mathbf{p}_i|}{E+m} \right)^{-1} \left(e^{+ip^\mu x_\mu} \right) \left(e^{+ip^\mu x_\mu} \right)^{-1} \right)_p \left(\left(\frac{E-m}{-|\mathbf{p}|} \right) \left(\frac{-|\mathbf{p}|}{E+m} \right)^{-1} \left(e^{-ip^\mu x_\mu} \right) \left(e^{-ip^\mu x_\mu} \right)^{-1} \right)_e \\
 &\rightarrow \left(\left(\begin{array}{cc} E-m & -|\mathbf{p}_i| \\ -|\mathbf{p}_i| & E+m \end{array} \right) \begin{pmatrix} s_{e,-} e^{+iEt} \\ s_{i,+} e^{+iEt} \end{pmatrix} = 0 \right)_p \left(\left(\begin{array}{cc} E-m & -|\mathbf{p}| \\ -|\mathbf{p}| & E+m \end{array} \right) \begin{pmatrix} s_{e,+} e^{-iEt} \\ s_{i,-} e^{-iEt} \end{pmatrix} = 0 \right)_e \\
 &\rightarrow \left(\left(\begin{array}{cc} E-e\phi-m & -|\mathbf{p}_i-e\mathbf{A}| \\ -|\mathbf{p}_i-e\mathbf{A}| & E-e\phi+m \end{array} \right) \begin{pmatrix} s_{e,-} e^{+iEt} \\ s_{i,+} e^{+iEt} \end{pmatrix} = 0 \right)_p \\
 &\left(\left(\begin{array}{cc} E+e\phi-V-m & -\boldsymbol{\sigma} \cdot (\mathbf{p}+e\mathbf{A}) \\ -\boldsymbol{\sigma} \cdot (\mathbf{p}+e\mathbf{A}) & E+e\phi-V+m \end{array} \right) \begin{pmatrix} s_{e,+} e^{-iEt} \\ s_{i,-} e^{-iEt} \end{pmatrix} = 0 \right)_e
 \end{aligned}$$

where $()_e$ denotes electron, $()_p$ denotes unspinzied proton and $(()_e ()_p)$ denotes an electron-unspinzied proton system.

Reference

1. Hu, H. & Wu, M. (2010), Prespacetime Model II: Genesis of Self-Referential Matrix Law, & the Ontology & Mathematics of Ether. Prespacetime Journal, 1(10): pp. 1477-1507.