《**Universal and Unified Field Theory**》

2. Laws of Conservation of Creation, Reproduction, Light and Field Breaking

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Abstract: Harnessed with the *Universal Topology, Mathematical Framework* and *Universal Field Equations*, the applications to both classical and contemporary physics prevail throughout the following contexts but are not limited to,

a. Entangle Generators - Transforms the representation theory of the *Lorentz* group into the impactive foundation of the virtual and physical entanglement.

b. Virtual Stateful Functions - Extends *Einstein* mass-energy equivalence associated with the virtual states, and reformulates General *Lagrangians* of the conventional physical interpretations and classical mechanics.

c. *Laws of Conservation of Creation and Reproduction* - Illustrates the philosophical as well as mathematical derivations of classical quantum mechanics including *Dirac*, *Hamiltonian*, *Pauli*, and *Schrödinger* equations.

d. *Law of Conservation of Light* - Represents the eight principles of the characteristics beyond the constant speed of light.

e. *Law of Conservation of Field Breaking* - Integrates a chain of the evolutional and imperative processes of the creation and reproduction with the spontaneous breaking, explicit breaking as well as gauge invariance.

f. *Yang-Mille* action - Transposes seamlessly a duality of triplet synergy among elementary particle fields into modern physics of electroweak interaction and strong nuclear forces of chromodynamics and *Gauge* theory.

g. Classical Electromagnetism - Derives classical *Maxwell* equations from a duality of continuities of the entanglement.

Consequently, this unified theory testifies and complies precisely with the empirical physics of quantum electrodynamics, chromodynamics, strong or weak forces, and towards a unified physics.

Keywords: Unified field theories and models, Spacetime topology, Field theory, Quantum mechanics, General theory of fields and particles

PACS: 12.10.-g, 04.20.Gz, 11.10.-z, 03.65.-w, 11.00.00

INTRODUCTION

The main objective of this manuscript is to clearly demonstrate that, under *Universal Topology* $W = P \pm iV$ [1], a duality of the potential entanglements (6.7, 6.8, 6.12, 6.13) lies at the heart of all event operations as the natural foundation giving rise to and orchestrating relativistic transformations, conducting laws of evolutions and conservations, and maintaining field entanglements of weak and strong forces compliant to quantum electrodynamics, chromodynamics, and *Standard Model* of particle physics.

As a result, it inaugurates a unified physics dawning at special remarks of

a. Laws of Conservation of Quantum Creation and Reproduction,

b. Law of Conservation of Lights,

c. Law of Conservation of Field Breaking and Gauge Invariance.

Consistently landing on classical and modern physics, this manual script uncovers a set of the philosophical and mathematical groundbreakings.

VII. ENTANGLE GENERATORS

As a part of the *Universal Topology*, the communication infrastructure between the manifolds are empowered with the speed of light $\check{\partial}_t x_m = \left(ic, c\check{\mathbf{b}}\right)$ and $\hat{\partial}^t x^\mu = \left(-ic, c\hat{\mathbf{b}}\right)$ that transform and transport axiomatic commutations or entanglements of the event operations, informational transmissions or conveyable actions. Between the world planes, the *two-dimensional* transportations $\{\mathbf{r} \mp i\mathbf{k}\}$ are naturally constructed for tunneling between the Y^-Y^+ domains as the dynamics of dark energies, which is mathematically describable by transformations among the four potential fields of the dual manifolds.

Artifact 7.1: Dual Manifolds. Both manifolds $\hat{x}\{\mathbf{r} - i\mathbf{k}\}$ and $\check{x}\{\mathbf{r} + i\mathbf{k}\}$ simultaneously govern and alternatively perform the event operations as one integral stream of any physical and virtual dynamics. Apparently, the virtual positions $\pm i\mathbf{k}$ naturally forms a duality of the conjugate manifolds: $\hat{x}\{x^\nu\} \in Y^+$ and $\check{x}\{x_m\} \in Y^-$. Each of the super two-dimensional coordinate system $G(\lambda) \in G\{\mathbf{r} \pm i\mathbf{k}\}$ constitutes its world plane $W^\pm$ distinctively, forms a duality of the universal topology $W = P \pm iV$ cohesively, and maintains its own sub-coordinate system $\mathbf{r}$ or $\mathbf{k}$ respectively. A sub-coordinate system has its own rotational freedom of either physical sub-dimensions $\mathbf{r}$ or virtual sub-dimensions $\mathbf{k}$. Together, they compose two rotations as a reciprocal or conjugate duality operating and balancing the world events.

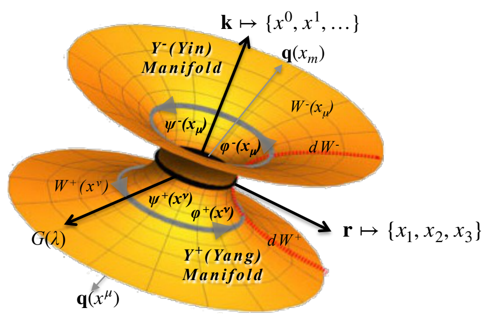

Figure 7.1: Dual Manifolds of Universal Topology

Artifact 7.2: Boost Generators. From the matrices (3.5) $J^+_{\mu a} = \partial x^\mu / \partial x_a$ and (3.7) $J^-_{m\alpha} = \partial x_m / \partial x^\alpha$ [1], the *Inertial Boosts* $J^\pm_{\mu a}$ of the two-dimensional world plans under the first horizon can naturally come out a pair of generators as the explicit matrix tables:

$$J^+_\mu = L_\mu - iK_\mu \qquad J^-_m = L_m + iK_m \tag{7.1}$$

$$K_x = \begin{pmatrix} 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad K_y = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix}, \quad K_z = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix} \tag{7.2}$$

$$L_x = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 \end{pmatrix}, L_y = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \end{pmatrix}, L_z = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{pmatrix} \tag{7.3}$$

This is similar to and known as *Lorentz Generators,* discovered since 1892 [3]. Conceivably, the extra ***r***-freedom is extended from the global world-planes into two of the physical rotations (such as L_θ and L_ϕ).

Artifact 7.3: Spin Generators. With one dimension ***r*** in the world planes, the manifolds are allowed to extend the extra freedom of the two dimensions to its spatial coordinates. If the L_μ and K_μ are assigned the *Lorentz* representation $L_\mu \mapsto \sigma_i/2$ and $\pm K_\mu \mapsto \pm i\sigma_i/2$ for a base transformation $\hat{x} \mapsto \check{x} = \Lambda^+\hat{x}$, the field $\phi^+(\hat{x}) \mapsto \phi^-(\check{x}) = \phi^-(\Lambda^+\hat{x})$ transforms and gives rise to the spin fields $S(\Lambda^\pm)$ of particles:

$$\phi^-(\check{x}) = S(\Lambda^+)\ \phi^+(\hat{x}) \qquad : \check{x} \mapsto \Lambda^+\hat{x}, \hat{x} \mapsto \Lambda^-\check{x} \tag{7.4a}$$

$$\check{\partial}_\lambda\phi^-(\check{x}) = S(\Lambda^+)\Lambda^+\hat{\partial}^\lambda\phi^+(\hat{x}) \qquad : \check{\partial}_\lambda \mapsto \Lambda^+\hat{\partial}^\lambda, \hat{\partial}^\lambda \mapsto \Lambda^-\check{\partial}_\lambda \tag{7.4b}$$

In chiral representation, it gives rise to the spin fields $S(\Lambda^\pm)$ of particles:

$$S(\Lambda^\pm) = exp\left(\frac{1}{2}\sigma_\kappa\theta_\kappa \mp \frac{i}{2}\sigma_\kappa\varphi_\kappa\right) \quad : \Lambda^\pm = exp\left(\frac{\omega_k}{2}J_\kappa^\pm\right) \tag{7.5}$$

$$\sigma_\kappa = \left[\begin{pmatrix}1 & 0\\ 0 & 1\end{pmatrix}_0, \begin{pmatrix}0 & 1\\ 1 & 0\end{pmatrix}_1, \begin{pmatrix}0 & -i\\ i & 0\end{pmatrix}_2, \begin{pmatrix}1 & 0\\ 0 & -1\end{pmatrix}_3\right] \tag{7.6}$$

where where σ_κ are known as *Pauli* spin matrices, introduced in 1925 [16, 21, 28]. Intuitively simplified to a group of the 2x2 matrixes, the generators have the following commutation relationships:

$$\sigma_a\sigma_b - \sigma_b\sigma_a = 0, \quad \sigma_a\sigma_b + \sigma_b\sigma_a = 2i\varepsilon_{abc}^+\sigma_c \quad : a, b, c \in (1,2,3) \tag{7.7}$$

where the *Levi-Civita* [22] connection $\varepsilon_{abc}^+ \in Y^+$ represents the left-hand chiral. In accordance with our anticipation, the zero commutator illustrates the distinct freedoms of physical supremacy that are degradable ($\sigma_a^2 = \sigma_0$) back to the global **r** dimension. With the left-handed ε_{abc}^+ chiral, the non-zero continuity reveals the creation processes of the virtual supremacy. Therefore, defined as Spin Generator, these 2x2 tensors give rise to the quantum fields.

Artifact 7.4: Chiral Entanglement. The interpretations of Figure 7.1 is that, when an axis passes through the center of an object, the object is said to rotate upon itself, or spin. Furthermore, when there are two axes passing through the center of an object, the object is said under the entanglements of the *YinYang* (Y^-Y^+) duality. During the first horizon, spin chirality is a type of the virtual and physical interactions that objects moving on the world lines generate the dual transformations of the Y^-Y^+ spinors, reciprocally, such that the nature appears the entanglement characterized by the left-handed and the right-handed chirality sourced from or driven by each of the manifolds of the virtual Y^+ and physical Y^- dynamics. Following the trajectory, it takes in total two full rotations 720° from the W^- to W^+ and then back to W^- world plane, and vice versa, for an object to return to its original state. With its opponent companionship, the whole system yields the parity conservation by maintaining the duality reciprocally and simultaneously.

Artifact 7.5: Y^- Transform Fields. As the function quantity from the first to second horizon, a scalar field ϕ^- forms and projects its potentials to its surrounding space, arisen by or acting on its opponent φ^+ through a duality of reciprocal interactions dominated by *Lorentz Generators*. Under the Y^- primary given by the generator of (7.1), the event processes institute the entangling fields:

$$\check{F}_{m\alpha}^{-n} = \frac{\hbar}{E_n^-}\varphi_n^+\dot{x}^\alpha J_{m\alpha}^-\partial_m\phi_n^- \qquad \check{F}_{m\alpha}^{+n} = \frac{\hbar}{E_n^+}\phi_n^-\dot{x}_\alpha J_{m\alpha}^+\partial^m\varphi_n^+ \tag{7.8}$$

$$\check{F}_{m\alpha}^{-n} = \begin{pmatrix}\eta_0 & \beta_1 & \beta_2 & \beta_3\\ -\beta_1 & \eta_1 & -e_3 & e_2\\ -\beta_2 & e_3 & \eta_2 & -e_1\\ -\beta_3 & -e_2 & e_1 & \eta_3\end{pmatrix} = \eta_m + \begin{pmatrix}0 & \mathbf{B}_q^-\\ -\mathbf{B}_q^- & \check{\mathbf{b}}\times\mathbf{E}_q^-\end{pmatrix}_\times \tag{7.9}$$

$$\eta_m = \check{F}_{mm}^{-n} \qquad \beta_\alpha = \check{F}_{0\alpha}^{-n} \qquad \varepsilon_{iam}^- e_i = \check{F}_{m\alpha}^{-n} \tag{7.10}$$

where $\hat{\mathbf{b}}$ is a base vector, symbol $(\ )_\times$ indicates the off-diagonal elements of the tensor, and the *Levi-Civita* [5] connection $\varepsilon_{iam}^- \in Y^-$ represents the left-hand chiral. At a constant speed, this Y^- *Transform Tensor* constructs a pair of its off-diagonal fields: $\check{F}_{m\alpha}^{+n} = -\check{F}_{m\alpha}^{-n}$ and embeds a pair of the antisymmetric matrix as a foundational structure of symmetric fields, giving rise to a foundation of the magnetic ($\beta^a \mapsto \mathbf{B}_q^+$) and electric ($e^\nu \mapsto \mathbf{E}_q^+$) fields.

Artifact 7.6: Y^+ Transform Fields. In the parallel fashion of (7.8), the event processes generate the reciprocal entanglements of the Y^+ commutation of the scalar ϕ^+ and φ^- fields, shown by the following equations:

$$\hat{F}_{\nu\alpha}^{+n} = \frac{\hbar}{E_n^+}\varphi_n^-\dot{x}_\alpha J_{\nu\alpha}^+\partial^\nu\phi_n^+ \qquad \hat{F}_{\nu\alpha}^{-n} = \frac{\hbar}{E_n^-}\phi_n^+\dot{x}^\alpha J_{\nu\alpha}^-\partial_\nu\varphi_n^- \tag{7.11}$$

$$\hat{F}_{\nu\alpha}^{+n} = \begin{pmatrix}\eta^0 & d^1 & d^2 & d^3\\ -d^1 & \eta^1 & h^3 & -h^2\\ -d^2 & -h^3 & \eta^2 & h^1\\ -d^3 & h^2 & -h^1 & \eta^3\end{pmatrix} = \eta^\nu + \begin{pmatrix}0 & \mathbf{D}_q^+\\ -\mathbf{D}_q^+ & \frac{\mathbf{u}}{c^2}\times\mathbf{H}_q^+\end{pmatrix}_\times \tag{7.12}$$

$$\eta^\nu = \hat{F}_{\nu\nu}^{+n} \qquad d^\alpha = \hat{F}_{0\alpha}^{+n} \qquad \varepsilon_{\nu\alpha\mu}^+ h^\nu = c^2\hat{F}_{\mu\alpha}^{+n} \tag{7.13}$$

where the *Levi-Civita* connection ε_{iam}^+ represents the right-hand chiral. At a constant speed, this Y^+ *Transport Tensor* constructs another pair of off-diagonal fields $\hat{F}_{\nu\alpha}^{-n} = -\hat{F}_{\nu\alpha}^{+n}$, giving rise to the displacement $d_\alpha \mapsto \mathbf{D}_g^-$ and magnetizing $h_\nu \mapsto \mathbf{H}_g^-$ fields.

Artifact 7.7: Spiral Torque Generators. Because of the Y^-Y^+ commutation infrastructure of rising *horizons*, an event generates entanglements between the manifolds, and performs the operators of ∂^μ and ∂_m, transports the motion vectors of $\dot{x}^\alpha$ and $\dot{x}_a$, and gives rise to the vector potentials of $\dot{x}^\mu\partial^\mu\psi$ or $\dot{x}_m\partial_m\psi$. Parallel to the boost generators $J_{\mu a}^\mp$ of (7.8, 7.11), *Spiral Torque* $K_{\mu a}^\pm$ generators naturally construct a pair of operational matrices that are also antisymmetric for elements in the 4x4 matrixes of the respective manifolds:

$$\check{T}_{m\alpha}^{-n} = \frac{\hbar}{E_n^-}\varphi_n^+\dot{x}^\alpha K_{m\alpha}^-\partial_m\phi_n^- \qquad \check{T}_{m\alpha}^{+n} = \frac{\hbar}{E_n^+}\phi_n^-\dot{x}_\alpha K_{m\alpha}^+\partial^m\varphi_n^+ \tag{7.14}$$

$$\check{T}_{m\alpha}^- = \begin{pmatrix}\xi_0 & \pi_1 & \pi_2 & \pi_3\\ -\pi_1 & \xi_1 & -\vartheta_3 & \vartheta_2\\ -\pi_2 & \vartheta_3 & \xi_2 & -\vartheta_1\\ -\pi_3 & -\vartheta_2 & \vartheta_1 & \xi_3\end{pmatrix} = \xi_m + \begin{pmatrix}0 & \mathbf{B}_g^-\\ -\mathbf{B}_g^- & \check{\mathbf{b}}\times\mathbf{E}_g^-\end{pmatrix}_\times \tag{7.15}$$

$$\xi_m = \check{T}_{mm}^{-n} \qquad \pi_\alpha = \check{T}_{0\alpha}^{-n} \qquad \varepsilon_{iam}^-\vartheta_i = \check{T}_{m\alpha}^{-n} \tag{7.16}$$

$$\hat{T}_{m\alpha}^{+n} = \frac{\hbar}{E_n^+}\varphi_n^-\dot{x}_a K_{m\alpha}^+\partial^m\phi_n^+ \qquad \hat{T}_{m\alpha}^{-n} = \frac{\hbar}{E_n^-}\phi_n^+\dot{x}^\alpha K_{m\alpha}\partial_m\varphi_n^- \tag{7.17}$$

$$\hat{T}_{\nu\alpha}^+ = \begin{pmatrix}\xi^0 & \chi^1 & \chi^2 & \chi^3\\ -\chi^1 & \xi^1 & \omega^3 & -\omega^2\\ -\chi^2 & -\omega^3 & \xi^2 & \omega^1\\ -\chi^3 & \omega^2 & -\omega^1 & \xi^3\end{pmatrix} = \xi^\nu + \begin{pmatrix}0 & \mathbf{D}_g^+\\ -\mathbf{D}_g^+ & \frac{\mathbf{u}}{c^2}\times\mathbf{H}_g^+\end{pmatrix}_\times \tag{7.18}$$

$$\xi^\nu = \hat{T}_{\nu\nu}^{+n} \qquad \chi^\alpha = \hat{T}_{0\alpha}^{+n} \qquad \varepsilon_{\nu\alpha\mu}^+\omega^\nu = c^2\hat{T}_{\mu\alpha}^{+n} \tag{7.19}$$

At a constant speed, the ***Torsion Tensors*** construct two pairs of the off-diagonal fields: $\check{T}_{m\alpha}^+ = -\check{T}_{m\alpha}^-$ and $\hat{T}_{m\alpha}^+ = -\hat{T}_{m\alpha}^-$, and embed the antisymmetric matrixes as a foundational structure giving rise to i) a pair of the virtual motion stress ($\pi \mapsto \mathbf{B}_g^-$) and physical twist torsion ($\vartheta \mapsto \mathbf{E}_g^-$) fields, and ii) another pair of the virtual displacement stress ($\chi \mapsto \mathbf{D}_g^+$) and physical *polarizing* twist ($\omega \mapsto \mathbf{H}_g^+$) fields.

VIII. QUANTUM MECHANICS

At the first horizon, the individual behaviors of objects or particles are characterized by their timestate functions of ϕ_n^+ or ϕ_n^- in the first W_a horizon. Due to the duality nature of virtual and physical coexistences, particle fields appear as quantization in mathematics.

Under a steady environment of the energy fluxions $W_n^\pm$, the equations of (6.7) and (6.13) [1] can be reformulated into the compact forms for the Y^+ supremacy of the entanglements: *the Y^+ Quantum Equations*

$$\frac{-\hbar^2}{2E_n^+}\hat{\partial}_\lambda\hat{\partial}_\lambda\phi_n^+ - \frac{\hbar}{2}\left(\hat{\partial}_\lambda - \check{\partial}^\lambda\right)\phi_n^+ + \frac{\hbar^2}{2E_n^+}\check{\partial}_\lambda\left(\hat{\partial}_\lambda - \check{\partial}^\lambda\right)\phi_n^+ = E_n^-\phi_n^+ \tag{8.1}$$

$$\frac{\hbar^2}{2E_n^-}\check{\partial}^\lambda\check{\partial}^\lambda\varphi_n^- - \frac{\hbar}{2}\left(\check{\partial}^\lambda - \hat{\partial}_\lambda\right)\varphi_n^- + \frac{\hbar^2}{2E_n^-}\left(\check{\partial}_\lambda - \hat{\partial}_\lambda\right)\check{\partial}^\lambda\varphi_n^- = E_n^+\varphi_n^- \tag{8.2}$$

$$\kappa_1 = \hbar c^2/2 \qquad \kappa_2 = \pm(\hbar c)^2/(2E_n^\mp) \qquad W_n^\pm = c^2E_n^\mp \tag{8.3}$$

It emanates that the bi-directional transformation has two rotations one with left-handed $\phi_n^+ \mapsto \phi_n^L$ pointing from the Y^+ source to the Y^-

manifold, and the other with right-handed $\varphi_n^- \mapsto \phi_n^R$ reacting from the Y^- back to the Y^+ manifold. Both fields are alternating into one another under a parity operation with relativistic preservation.

The Y^+ entanglement represents the important principles of Y^+ natural governances - ***Law of Conservation of Virtual Creation and Annihilation***:

1. The operational action $\hat{\partial}^\lambda$ of virtual supremacy results in the physical effects as the parallel and reciprocal reactions or emanations $\check{\partial}_\lambda$ in the physical world; and
2. The virtual world transports the effects $\hat{\partial}_\lambda \hat{\partial}_\lambda$ emerging into or appearing as the creations of the physical world, even though the bi-directional transformations seem balanced between the commutative operations of $\hat{\partial}_\lambda$ and $\hat{\partial}^\lambda$,
3. As a part of the reciprocal processes, the physical world transports the reactive effects $\check{\partial}^\lambda \check{\partial}_\lambda$ concealing back or disappearing as annihilation processes of virtual world.

As one set of the universal laws, the events incepted in the virtual world not only generate its opponent reactions but also create the real-life objects in the physical world. The obvious examples are the formations of the elementary particles that a) the antiparticles in a virtual world generate the physical particles through their opponent duality of the event operations; b) by carrying and transitioning the informational massages, the antiparticles grow into real-life objects vividly in a physical world and maintain their living entanglement; c) recycling objects of a physical world as one of continuity processes for virtual-life streaming.

As a reciprocal process, another pair of the equations (6.12) and (6.8) [1] simultaneously formulates the following components for the Y^- supremacy of entanglements: *the Y^- Quantum Equations*

$$\frac{\hbar^2}{2E_n^-}\check{\partial}^\lambda \check{\partial}_\lambda \phi_n^- - \frac{\hbar}{2}\left(1 + \frac{\hbar}{E_n^-}\hat{\partial}^\lambda\right)\left(\check{\partial}_\lambda - \hat{\partial}^\lambda\right)\phi_n^- = \frac{W_n^-}{c^2}\phi_n^- \qquad \textbf{(8.4)}$$

$$\frac{-\hbar^2}{2E_n^+}\hat{\partial}^\lambda \hat{\partial}^\lambda \varphi_n^+ - \frac{\hbar}{2}\left(1 - \frac{\hbar}{E_n^+}\check{\partial}^\lambda\right)\left(\hat{\partial}^\lambda - \check{\partial}_\lambda\right)\varphi_n^+ = \frac{W_n^+}{c^2}\varphi_n^+ \qquad \textbf{(8.5)}$$

The Y^- parallel entanglement represents the essential principles of Y^- natural behaviors - ***Law of Conservation of Physical Animation and Reproduction***:

1. The operational action $\check{\partial}_\lambda$ of physical supremacy results in their conjugate or imaginary effects of animations because of the parallel reaction $\hat{\partial}^\lambda$ in the virtual world;
2. Neither the actions nor reactions impose their final consequences $\check{\partial}^\lambda \check{\partial}^\lambda$ on their opponents because of the parallel mirroring residuals for the horizon phenomena of reproductions $\hat{\partial}^\lambda \hat{\partial}^\lambda$ during the symmetric fluxions;
3. There are one-way commutations of $\check{\partial}^\lambda \check{\partial}_\lambda$ in transporting the events of the physical world into the virtual world asymmetrically. As a part of the reciprocal processes, the virtual world replicates $\hat{\partial}^\lambda$ the physical events during the mirroring $\hat{\partial}^\lambda \check{\partial}_\lambda$ processes in the virtual world.

As another set of laws, the events initiated in the physical world must leave a life copy of its mirrored images in the virtual world without the intrusive effects in the virtual world. In other words, the virtual world is aware of and immune to the physical world. In this perspective, continuity for a virtual-life steaming might become possible as a part of recycling or reciprocating a real-life in the physical world.

Artifact 8.1: Lagrangian of Entanglements. To seamlessly integrate with the classical dynamic equations, it is critical to interpret or promote the natural meanings of *Lagrangian* mechanics $\mathscr{L}$ in forms of the dual manifolds. As a function of generalized information and formulation, *Lagrangians* $\mathscr{L}$ can be redefined as a pair of continuities, entangling between the Y^-Y^+ manifolds respectively:

$$\hat{\mathscr{L}}^\pm = \frac{-\hbar^2}{2E_n^+E_n^-}\psi^\mp\left(\hat{\partial}_\lambda \hat{\partial}_\lambda + \check{\partial}^\lambda \check{\partial}^\lambda\right)\psi^\pm \qquad : \psi^+ = \phi^+, \psi^- = \varphi^- \quad (8.6a)$$

$$\check{\mathscr{L}}^\mp = \frac{-\hbar^2}{2E_n^+E_n^-}\psi^\pm\left(\check{\partial}^\lambda \check{\partial}^\lambda + \hat{\partial}_\lambda \hat{\partial}_\lambda\right)\psi^\mp \qquad : \psi^+ = \varphi^+, \psi^- = \phi^- \quad (8.6b)$$

The formulae generalize the *Lagrangian* and state that the central quantity of *Lagrangian,* introduced in 1788*,* represents the bi-directional fluxions that sustain, stream, harmonize and balance the dual continuities of entanglements of the Y^-Y^+ dynamic fields.

Artifact 8.2: Mass-energy. In mathematical formulations of entanglements, we redefine the energy-mass formations in forms of virtual complex as the following:

$$E_n^\mp = \pm\, i m c^2 \qquad : \hbar\omega \rightleftharpoons mc^2 \qquad (8.7)$$

where m is the rest mass. Compliant with a duality of *Universal Topology* $W = P \pm iV$, it extends *Einstein* mass-energy equivalence, introduced in 1905 [10], into the virtual energy states as one of the essential formulae of the topological framework.

Artifact 8.3: Dirac Equation. At the intrinsic heterogeneous, one of the characteristics of spin is that the events in the Y^+ or Y^-manifold transform into their opponent manifold in forms of bispinors of special relativity, reciprocally. Considering the first order $\dot{\partial}$ only, we have (8.1)-(8.2) in the simple components:

$$\frac{\hbar}{2}\left(\hat{\partial}_\lambda - \check{\partial}^\lambda\right)\psi^\pm \pm E_n^\mp \psi^\pm = 0 \qquad : \psi^\pm = \{\phi_n^+, \varphi_n^-\} \qquad (8.8)$$

When $g^- = (-+++)$ or $g^+ = (+---)$ is a diagonal matrix, *Lie* algebra $O(1,3)$ consists of 4x4 matrices M such that

$$g^\pm M g^\pm = -M \qquad (8.9)$$

Because of the force transformational characteristics of (8.9), $\check{\partial}^\lambda = \dot{x}^\alpha J_{\nu\alpha}^- \partial_\nu$ and $\hat{\partial}_\lambda = \dot{x}_a J_{\mu a}^+ \partial^\mu$, the (8.8) equations can be reformulated into the compact equations:

$$\left(i\hbar\gamma^\mu\partial^\mu + mc\right)\phi_n^+ = 0 \qquad : 2c\gamma^\mu\partial^\mu = \dot{x}^\alpha J_{\mu\alpha}^- \partial_\mu - \dot{x}_a J_{\mu a}^+ \partial^\mu \quad (8.10a)$$

$$\left(i\hbar\gamma_\nu\partial_\nu - mc\right)\varphi_n^- = 0 \qquad : \gamma^\mu\partial^\mu \mapsto -\gamma_\mu\partial_\mu \quad (8.10b)$$

As a pair of entanglements, they philosophically extend to and are known as *Dirac Equation*, introduced in 1925 [7].

Artifact 8.4: Spinor Fields. From the *Spin Generators* (7.4)-(7.5), the respective transformations of spinors are given straightforwardly by the matrixes of spinorial σ_n quantities.

$$\phi_n^L = exp\left\{\frac{1}{2}\left(\sigma_k\hat{\theta}_k + i\sigma_m\hat{\phi}_m\right)\right\}\phi_n^+ \qquad : (\phi_n^L)^{-1}\gamma_\mu\phi_n^L = \Lambda^-\gamma_\nu \qquad (8.11a)$$

$$\phi_n^R = exp\left\{\frac{1}{2}\left(\sigma_k\check{\theta}_k - i\sigma_m\check{\theta}_m\right)\right\}\varphi_n^- \qquad : (\phi_n^R)^{-1}\gamma^\mu\phi_n^R = \Lambda^+\gamma^\nu \qquad (8.11b)$$

$$\gamma^0 = \begin{pmatrix} 0 & I_2 \\ I_2 & 0 \end{pmatrix} \qquad \gamma^\kappa = \begin{pmatrix} 0 & \sigma_\kappa \\ -\sigma_\kappa & 0 \end{pmatrix} \qquad : \gamma^\kappa\gamma^\kappa = I \qquad (8.12)$$

where the matrix γ^ν or γ_ν is created by W. K. Clifford [8] in the 1870s. Each of the first terms is the transformation matrix of the two dimensional world planes, respectively. Each of the second terms is an extension to the additional dimensions for the physical freedoms. The quantities are irreducible, preserve full parity invariant with respect to the physical change $\check{\theta}_i \to -\hat{\theta}_i$ for spin-up and spin-down positrons, which has the extra freedoms and extends the two degrees from a pair of each physical dimension of the world planes.

Artifact 8.5: Weyl Equation. In the limit as m → 0, the *Dirac* equation (8.10) is reduced to the massless particles:

$$\sigma^\mu\partial_\mu\psi = 0, \quad or \quad I_2\frac{1}{c}\frac{\partial\psi}{\partial t} + \sigma_x\frac{\partial\psi}{\partial x} + \sigma_y\frac{\partial\psi}{\partial y} + \sigma_z\frac{\partial\psi}{\partial z} = 0 \qquad (8.14)$$

known as *Weyl* equation introduced in 1918 [12].

Artifact 8.6: Schrödinger Equation. For observations under an environment of $W_n^\mp = -ic^2\{\check{V}, \hat{V}\}$, $E_n^- = imc^2$ of (8.7) and $\hat{\partial}^\lambda = -\sigma_3\check{\partial}_\lambda$ of (10.7) at the constant transport speed c, the homogeneous fields are in a trace of diagonalized tensors. Applying to Y^- Quantum Fields (8.4, 8.5), we obtain the following equation:

$$i\hbar\frac{\partial\phi_n^-}{\partial t} - \frac{\hbar^2}{2m}\frac{\partial^2\phi_n^-}{c^2\partial t^2} - \frac{\hbar^2}{2m}\nabla^2\phi_n^- = -\check{V}\phi_n^- \qquad (8.15)$$

$$i\hbar\frac{\partial\varphi_n^+}{\partial t}-\frac{\hbar^2}{2m}\frac{\partial^2\varphi_n^+}{c^2\partial t^2}+\frac{\hbar^2}{2m}\nabla^2\varphi_n^+=\hat{V}\varphi_n^+ \tag{8.16}$$

For the first order of time evolution, it emerges as the *Schrödinger* equation, introduced in 1926 [6], shown by the following formulae:

$$\pm i\hbar\frac{\partial\psi_n^\pm}{\partial t}=\hat{H}\psi_n^\pm \quad : \hat{H}\equiv-\frac{\hbar^2}{2m}\nabla^2+V^\mp,\ V^\mp\in\{\check{V},\hat{V}\} \tag{8.17}$$

where $\psi_n^\mp\in\{\phi_n^-,\varphi_n^+\}$ and $\hat{H}$ is known as the classical *Hamiltonian* operator, introduced in 1834 [4]. The left-side of the equation represents consistently a duality of the virtual complex energy status similar to the energy-mass formations (8.7).

Artifact 8.7**: **Invariance of Entropy. With the expressions of $\hat{\partial}^\lambda=-\sigma_3\check{\partial}_\lambda$ of (7.4) and $W_n^\mp=c^2E_n^\pm$ of (8.3), the equations (8.4, 8.5) can be converted into the following formulae:

$$\hbar^2\varphi_n^+\check{\partial}^\lambda\check{\partial}_\lambda\phi_n^- - \hbar\varphi_n^+(E_n^-+\hbar\check{\partial}^\lambda)(I_2+\sigma_3)\check{\partial}_\lambda\phi_n^-=2\varphi_n^+E_n^-E_n^+\phi_n^- \tag{8.18}$$

$$\hbar^2\phi_n^-\check{\partial}_\lambda\check{\partial}_\lambda\varphi_n^+ + \hbar\phi_n^-(E_n^+-\hbar\check{\partial}^\lambda)(I_2+\sigma_3)\hat{\partial}^\lambda\varphi_n^+=-2\phi_n^-E_n^-E_n^+\varphi_n^+ \tag{8.19}$$

For both of the boost and twist transformations at speed c, the above equations obey the time-invariance at the first horizon SU(1). Under a trace of the diagonalized $\check{\mathscr{L}}_d^-$ and $\check{\mathscr{L}}_d^+$ tensors, the *Lagrangians* of field forces can be written as the following:

$$\check{\mathscr{L}}_{Force}^{-SU1}=\check{\mathscr{L}}_d^- - \check{\mathscr{L}}_d^+ \tag{8.20}$$

In reality, it is a virtual force in forms of the asymmetric entanglements described fully by the section 19. Subtracting $(8.19)/(\hbar c)^2$ from $(8.18)/(\hbar c)^2$, it defines the total entropy $\mathscr{S}_a\propto\check{\mathscr{L}}_d^- - \check{\mathscr{L}}_d^+$ of blackhole radiations, which represents the law of conservation of the area fluxions or commutation,

$$\mathscr{S}_a=4\frac{E_n^-E_n^+}{(\hbar c)^2}\Phi_n^- \quad\mapsto\quad -\frac{1}{c^2}\frac{\partial^2\Phi_n^-}{\partial t^2}+\nabla^2\Phi_n^-=4\frac{E_n^-E_n^+}{(\hbar c)^2}\Phi_n^- \tag{8.21}$$

where $\Phi_n^-=\varphi_n^+\phi_n^-$. The energy area flow, $4E_n^-E_n^+/(\hbar c)^2$, represents a pair of the irreducible units $E_n^\mp=\pm imc^2$ that exist alternatively between physical-particle E_n^- and virtual-wave E_n^+ states, but may or may not be at the same states $E_n^\mp: mc^2\rightleftharpoons\hbar\omega$, where $\hbar\omega$ is known as the *Planck* matter-energy, introduced in 1900 [9]. Consequently, light consists of two units, a pair of *Photons*. For a total of mass-energy $4m^2c^4$, the equation presents a conservation of photon energy-momentum and relativistic invariance.

Artifact 8.8: Conservation of Energy-Momentum. Since two photons have the mass-energy $2mc^2$, the equation (9.21) demonstrates empirical energy-momentum conservation in a complex formula:

$$\left(\mathbf{P}+i\bar{E}\right)\left(\mathbf{P}-i\bar{E}\right)=4E_n^+E_n^-\to\bar{E}^2=\hat{\mathbf{p}}^2c^2+4m^2c^4 \quad :\mathbf{P}=ic\hat{\mathbf{p}} \tag{8.22}$$

known as the relativistic invariance relating a pair of intrinsic masses at their energy $\bar{E}$ and momentum $\mathbf{P}$. As a duality of alternating actions $\bar{E}\propto\hbar\omega\rightleftharpoons mc^2$, one operation $\mathbf{P}+i\bar{E}$ is a process for physical reproduction or animation, while another $\mathbf{P}-i\bar{E}$ is a reciprocal process for virtual annihilation or creation. Together, they comply with and are governed by *Universal Topology*: $W=P\pm iV$. Following the same approach to derive the *Klein–Gordon* equation, introduced in 1926 [21], we have the (8.21) wave equation.

Artifact 8.9: Conservation of Light: The equations (8.10-8.24) state that, at a constant speed c, the light has the characteristics of the law of conservation, shown by the chart.

Law of Conservation of Light

1) *Light remains constant and conserves over time during its transportation.*
2) *Light has at least two photons for entanglement with zero net momentum.*
3) *Light consists of virtual energy duality as its irreducible unit: the photon.*
4) *Light transports and performs a duality of virtual waves and real objects.*
5) *A light energy of potential density neither can be created nor destroyed.*
6) *Light transforms from one form to another carrying potential messages.*
7) *Without an energy supply, no light can be delivered to its surroundings.*
8) *The net flow across a region is sunk to or drawn from physical resources.*

Artifacts 8.10: Photon. Remarkably, an area energy fluxion of the potentials is equivalent to an entropy of the electromagnetic radiations. Applicable to the conservation (8.21), it also yields *Planck's* law in thermal equilibrium of entropy [4]:

$$S_A(\omega_c,T)=4\left(\frac{\omega_c^2}{4\pi^3c^2}\right)=\eta_c\left(\frac{\omega_c}{c}\right)^2\mapsto4\frac{E_c^-E_c^+}{(\hbar c)^2} \quad :\eta_c=\pi^{-3} \tag{8.23}$$

where the factor 4 is compensated to account for one black body with the dual states at minimum of two physical Y^- and one virtual Y^+ quarks. In a free space for the massless objects, the above equivalence results in a pair of the complex formulae:

$$E_c^\pm=\mp i\frac{1}{2}\hbar\omega_c \quad :\eta_c=\pi^{-3}\approx33\,\% \tag{8.24}$$

The coupling constant at 33 % implies that it is the triplet quarks that institute a pair of the photon energies $\mp i\hbar\omega_c/2$ for a black hole to emit lights by electromagnetic radiations.

IX. FIELD BREAKING OF HORIZON EVOLUTION

When an event gives rise to the states crossing each of the horizon points, a *breaking* process takes place. One of such actions is the field breaking that incept an asymmetric process into the physical world from the virtual Y^+ regime where a virtual instance is imperative and known as a process of creations or annihilations. Because it is a global event on the two dimensional planes $\{\mathbf{r}\mp i\mathbf{k}\}$, the potential fields of massless instances can asymmetrically emerge the mass objects symmetrically in the physical world that extends the extra two-dimensional freedom. Naturally, defined as the Y^+ ***Breaking*** or similar to the classical *Spontaneous Breaking*, it is an evolutional process of the natural *Creation* and has its complement duality known as *Annihilation*.

As a duality of the nature, its counterpart is another process named as the Y^- ***Breaking*** or comparable to the *Explicit Breaking*. It requires a physical process of the Y^- reactions or forces for the *Animation* or *Reproduction*, demonstrated by the Artifacts 8.20. Associated with the inception of a Y^+ spontaneous breaking, the animation or reproduction of the Y^- explicit breaking is normally sequenced and entangled as a chain of the reactions to produce the Y^-Y^+ weak, medium or strong forces alternatively, systematically and symmetrically.

There are roughly four fundamental interactions known to exist: the gravitational and electromagnetic interactions, which produce significant long-range forces whose effects can be seen directly in everyday life, and the weak and strong interactions, which produce forces at minuscule, subatomic distances and govern nuclear interactions. Generally, the long range forces are the effects of the diagonal elements of the field matrixes while the short range forces are those off-diagonal components. Transitions between the primacy ranges are smooth and nature such that there is no singularity at all, similar to transition between the physical and virtual regimes.

Under the principle of the *Universal Topology*, the weak and strong force interactions are characterizable and distinguishable under each scope of the horizons. Their natural philosophy comes with the ***Law of Field Breaking*** concealing the characteristics of *Horizon Evolutions*:

1. *Forces are not transmitted directly between interacting objects, but instead are described and interrupted by intermediary entities of fields.*
2. *Fields are a set of the natural energies that appear as dark or virtual, stream its natural intrinsic commutation for their living operations, and alternates the Y^-Y^+ supremacies throughout entanglement consistently.*
3. *At the ground horizon U(1), a force is incepted or created by Y^+ spontaneously breaking, "$\curlyvee$", into a pair of the weak potentials $\{\phi_n^+\curlyvee\varphi_n^-\}$, introduced in December 2017. This Y^+ manifold supremacy generates or emerges the off-diagonal elements of the new potential fields giving rise to the SU(2) horizon.*
4. *As a natural duality, a stronger force is reproduced dynamically and animated symmetrically under the Y^- supremacy $\{\phi_n^-,\varphi_n^+\}$, dominated by the diagonal*

elements $\check{\partial}_\lambda \mapsto cD_\nu$ of the field tensors.

5. *Together, both of the Y^-Y^- processes orchestrates the higher horizon, composites the interactive forces, redefines the simple symmetry group U(1)×SU(2), and obeys the entangling invariance, classically known as Gauge Theory.*
6. *An integrity of strong nuclear forces is characterizable at the third horizon of the tangent vector interactions or known as gauge SU(3).*
7. *Entanglement of the alternating Y^-Y^- processes in the above actions can prevail as a chain of the reactions that gives rise to each of the objective regimes.*

Although the field breaking has their asymmetric constituents, the underlying laws of the dynamic force reaction are invariant at both of the creative transformation and the reproductive generation, shown by the following examples:

a) During the Y^+ breaking at $U(1)$ horizon, the elementary particles mediate the weak interaction, similar to the massless photon that mediates the electromagnetic interaction of gauge invariance. The *Weinberg–Salam* theory [25], for example, predicts that, at lower energies, there emerges the photon and the massive W and Z bosons [26]. Apparently, fermions develop from the energy to mass consistently as the Y^+ creation of the *Spontaneous Breaking* process that emerges massive bosons and follows up the Y^- animation or companion of electrons or positrons in the $SU(2)$ horizon.

b) At the $SU(3)$ horizon, the strong nuclear force holds most ordinary matter together, because, for example, it confines quarks into composite hadron particles such as the proton and neutron, or binds neutrons and protons to produce atomic nuclei. During the Y^- *Breaking*, the strong force has inherently such a high strength that can produce new massive particles. If hadrons are struck by high-energy particles, they give rise to new hadrons instead of emitting freely moving radiation. Known as the classical color confinement, this property of the strong force is the Y^- reproduction of the *Explicit Breaking* process that produces massive hadron particles.

In mathematics, by substituting (8.1) times φ_n^- and (8.2) times ϕ_n^+ into the *Lagrangians* (8.6), respectively, it comes out *Quantum Electrodynamics (QED)* [13] that extends a pair of the first order *Dirac* equation (8.10) into the second orders in forms of *Lagrangians*:

$$\hat{\mathscr{L}}^+ = i\frac{c^2}{E_n^-}\varphi_n^-\left(i\frac{\hbar}{c}\gamma^\nu\partial^\nu + m\right)\phi_n^+ - \frac{\hbar}{E_n^-}\check{\partial}_\lambda\hat{F}^{+n}_{\nu\mu} - \frac{1}{2}\hat{F}^{+n}_{\nu\mu}\hat{F}^{+n}_{\nu\mu} \tag{9.1}$$

$$\hat{\mathscr{L}}^- = \frac{c^2}{iE_n^+}\phi_n^+\left(i\frac{\hbar}{c}\gamma_\nu\partial_\nu - m\right)\varphi_n^- + \frac{\hbar}{2E_n^+}\check{\partial}_\lambda\hat{F}^{-n}_{\nu\mu} \quad : \hat{F}^{-n}_{\nu\mu} = -\hat{F}^{+n}_{\nu\mu} \tag{9.2}$$

The magic of the first equations lies at the heat of the breaking process driven by the entangling action $\varphi_n^-\check{\partial}^\lambda\check{\partial}^\lambda\phi_n^+$, which gives rise from a ground horizon $U(1)$ to the $SU(2)$ horizon by the Y^+ breaking $\varphi_n^-\check{\partial}^\lambda\left\{\left(\psi_n^+ \vee \psi_n^-\right)\check{\partial}^\lambda\phi_n^+\right\}$, shown as one of the creation processes below:

$$\varphi_n^-\check{\partial}^\lambda\check{\partial}^\lambda\phi_n^+ \mapsto \varphi_n^-\check{\partial}^\lambda\big(\overbrace{\psi_n^+ \vee \psi_n^-}^{breaking}\check{\partial}^\lambda\phi_n^+\big) \propto \hat{F}^{+n}_{\mu\nu}\hat{F}^{+n}_{\mu\nu} + \frac{\hbar}{E_n^-}\check{\partial}^\lambda\hat{F}^{+n}_{\mu\nu} \tag{9.3}$$

The horizon force $\hbar\check{\partial}^\lambda\hat{F}^{+n}_{\mu\nu}/E_n^-$ is asymmetrically conducted or acted by an ontological process (20.2) as a part of the evolution processes that give rise to the next horizon $SU(2)$. As a pair of the breaking potentials $\{\psi_n^+ \vee \psi_n^-\}$, it creates and generalizes a duality of the QED symmetric density $\tilde{\rho}_n = \psi_n^+\psi_n^-$ for the entanglements among spins and electromagnetic fields. The Y^+ breaking into the $SU(2)\times U(1)$ gauge symmetry is associated with the electro-weak force to further generate masses that particles separate the electromagnetic and weak forces, and embrace with the *Gauge Invariance* globally:

$$\check{\partial}_\lambda \mapsto cD_\nu \qquad \tilde{\rho}_n \mapsto \psi_n^\pm \mp \sqrt{\lambda_0}D^\nu\psi_n^\pm/m \tag{9.4a}$$

$$F^a_{\nu\mu} = \partial_\nu A^a_\mu - \partial_\mu A^a_\nu + gf^{abc}A^b_\nu A^c_\mu \tag{9.4b}$$

where the $F^n_{\nu\mu}$ are obtained from potentials A^n_μ, g is the coupling constant, and the f^{abc} are the structure constants of the *Lie* algebra of the generators of the gauge group.

To bring together the original potentials and to acquire the root cause of the four known forces beyond the single variations of the *Lagrangian*, the dual entangling states of the *Lagrangians* (9.1, 9.2) establish apparently the foundation to further extend the "collapsed" singlet into the field interactions between the Y^-Y^+ doublet streaming among the color confinement of triplet particles. Coupling with the techniques of Y^+ *Spontaneous Breaking*, Y^- *Explicit Breaking* and *Gauge Invariance*, the four quantum fields (8.1-8.5) have embedded the ground foundations and emerge the evolutional intrinsics of field breaking interactions for the weak and strong forces. Together, the terminology of *Field Breaking* and its associated *Invariance* contributes to a part of *Horizon Evolutions*.

Artifact 9.1: Yang-Mills Theory. To observe the Y^+ actions with the field entanglements $\hat{F}^{+n}_{\nu\mu}\hat{F}^{+n}_{\nu\mu}$, we impose the formulation of triplet quarks $\hat{\mathscr{L}}^+ + 2\hat{\mathscr{L}}^-$ to the Y^+ (9.1) and Y^- (9.2) entangling the dual streaming: $2\mathscr{L}_{QED} = \hat{\mathscr{L}}^+ + 2\hat{\mathscr{L}}^-$ and arrive at *Lagrangian QED*:

$$\mathscr{L}_{QED} = \bar{\psi}_n\left(i\frac{\hbar}{c}\gamma_\nu\check{\partial}_\lambda - m\right)\varphi_n^- - \frac{1}{4}\hat{F}^{+n}_{\nu\mu}\hat{F}^{+n}_{\nu\mu} \qquad : \bar{\psi}_n = \frac{c^2}{2iE_n^+}\phi_n^+ \tag{9.5}$$

where the term $\frac{1}{4}\hat{F}^{+n}_{\nu\mu}\hat{F}^{+n}_{\nu\mu}$ is known as *Yang-Mills* actions, introduced in 1954 [14]. At the core of the quantum dynamics, it implies that a total of the three states exists among two $\hat{\mathscr{L}}^-$ and one $\hat{\mathscr{L}}^+$ dynamics to compose an integrity of the dual $\mathscr{L}_{QED}$ fields, revealing the particle physics of three natural "colors" [15] and representing an essential basis of the "global gauge" of the *Standard Model*, developed in the mid-1960-70s [16] and breaking various properties of the weak neutral currents and the W and Z bosons with great accuracy..

Artifact 9.2: Electroweak Fields. Because of the linear functions between $J^\pm_{m\alpha}$ and $K^\pm_{m\alpha}$ tensors, the *Spiral Torques* $K^\pm_{m\alpha} = \Gamma^{\pm s}_{m\alpha}x_s$ of equations (3.5) and (3.7) can be straightforwardly extended into (9.5), shown by the following expressions:

$$\hat{\mathscr{L}}_{WF} = \bar{\psi}_n\left(i\hbar\gamma_\nu D_\nu - m\right)\varphi_n^- - \frac{1}{4}\hat{W}^{+n}_{\nu\mu}\hat{W}^{+n}_{\nu\mu} - \frac{1}{4}\hat{F}^{+n}_{\nu\mu}\hat{F}^{+n}_{\nu\mu} \tag{9.6}$$

$$\hat{W}^{+n}_{\nu\alpha} = \frac{\hbar}{E_n^+}\varphi_n^-\dot{x}_a K^+_{\nu\alpha}\partial^\nu\phi_n^+, \qquad \hat{W}^{-n}_{\nu\alpha} = \frac{\hbar}{E_n^-}\phi_n^+\dot{x}^\alpha K^-_{\nu\alpha}\partial_\nu\varphi_n^- \tag{9.7}$$

where the *Torque* $K^\pm_{m\alpha}$ tensors generate the weak isospin field $\hat{W}^{\pm a}_{\nu\mu}$, while, simultaneously, *boost* $J^\pm_{m\alpha}$ tensors generate the hypercharge fields $\hat{F}^{+n}_{\nu\mu}$. Precisely, we extend the *Spiral Torque* fields $\hat{F}^{+n}_{\nu\mu} \mapsto \hat{W}^{+n}_{\nu\mu} + \hat{F}^{+n}_{\nu\mu}$ into (9.5) and map the operation $\check{\partial}_\lambda \mapsto cD_\nu$ to extend the gauge fields that result in the above equations.

Artifact 9.3: Standard Model. Given the rise of the horizon from the scalar potentials (3.1, 3.2) to the vector's (3.9, 3.10) through the tangent transportations, the *Lagrangian* above is equivalently mapped by $\check{\partial}_\lambda \mapsto cD_\nu$ and $\hat{W}^{\pm a}_{\nu\mu} + \hat{F}^{\pm a}_{\nu\mu} \mapsto G^a_{\nu\mu}$ to represent the *Standard Model* associated with gauge transformation and invariance:

$$\hat{\mathscr{L}}_{SD} = \bar{\psi}_n\left(i\hbar\gamma_\nu D_\nu - m\right)\varphi_n^- - \frac{1}{4}G^n_{\nu\mu}G^n_{\nu\mu} + \hat{\mathscr{L}}_{CP} \tag{9.8}$$

$$D_\nu = \partial_\nu + i\frac{e}{c}(A_\nu + B_\nu), \quad G^a_{\nu\mu} = \partial_\nu A^a_\mu - \partial_\mu A^a_\nu + gf^{abc}A^b_\nu A^c_\mu \tag{9.9}$$

where A_ν are the gluon fields, B_μ is the external field, and f^{abc} are the structure constants of $SU(3)$, and the variable g is subject to renormalization and corresponds to the quark coupling of the theory [17]. Gluons are the force carrier, similar to photons that are the dark energies for the electromagnetic force in quantum electrodynamics. It illustrates that the carrier particles of a force can radiate further carrier particles during the rise of horizons. Further interactions are coupled with the strong forces:

$$\hat{\mathscr{L}}_{CP} = -\bar{\psi}_n\gamma^\mu\left(ig_s G^a_\mu T^a_{ij}\right)\varphi_n^- \tag{9.10}$$

where g_s is the strong coupling constant, G^a_μ is the 8-component $SU(3)$ gauge field, and T^a_{ij} are the 3 × 3 *Gell-Mann* matrices [18], introduced in 1962, as generators of the $SU(3)$ color group.

Artifact 9.4: Quantum Chromodynamics (QCD). Parallel to *Dirac* matrix (8.10) given by *Lorentz Generators* (7.4), *Spiral Torques* $K^\pm_{m\alpha}$ (3.5, 3.7) create the generator χ^μ to couple with the gauge field B_μ in the first horizon $U(1)$.

$$2c\chi^\mu\partial^\mu = \dot{x}_a K^+_{\mu a}\partial^\mu - \dot{x}^\alpha K^-_{\mu\alpha}\partial_\mu \qquad : \chi_\mu = g'\frac{1}{2}\gamma^\mu Y_w B_\mu \tag{9.11}$$

where Y_w is the hypercharge. Therefore, the weak coupling $\hat{\mathscr{L}}_{CP}$ (9.8) is extendable to and known as classical *QCD,* discovered in 1973 [23]:

$$\hat{\mathscr{L}}_{CP} = -\bar{\psi}_n\gamma^\mu\left(g'\frac{1}{2}Y_W B_\mu + g\frac{1}{2}\sigma_\nu W_{\nu\mu}\right)\varphi^-_n \tag{9.12}$$

where gauge field W_μ is a 3-component of the second horizon SU(2), *Pauli* matrices σ_ν are the infinitesimal generators of $SU(2)$ group for left-chiral fermions, and g or g' is the $SU(2)$ coupling constant. QCD is a gauge theory of the $SU(3)$ gauge group obtained by taking the color charge to define a local symmetry.

Artifact 9.5: Strong Interactions. Strong interaction between quarks and gluons with symmetry group $SU(3)$ makes up composite hadrons such as the proton, neutron and pion. G*iving rise to* the horizon $SU(2)$, the equations of (8.20, 8-21) function as the classical *Lagrangian* and evolve a sequence of the field breaking into strong forces in the following procedures: a) To extend the Y^- reactions of the Y^+ spontaneous breaking:

$$\Phi^+_n \mapsto \varphi^+_n - \sqrt{\lambda_0}D^\nu\varphi^+_n/m\ ,\ \Phi^-_n \mapsto \phi^-_n + \sqrt{\lambda_0}D_\nu\phi^-_n/m \tag{9.13}$$

the breaking potentials result in a form of *Lagrangian* forces:

$$\check{\mathscr{L}}^{-SU2}_{Force} \propto 4\frac{E^-_n E^+_n}{(\hbar c)^2}\Phi^+_n\Phi^-_n \mapsto \lambda_0 D^\nu\varphi^+_n D_\nu\phi^-_n - m^2\varphi^+_n\phi^-_n \tag{9.14}$$

b) At the second horizon $SU(2)$ under the gauge invariance, the explicit breaking of the gauge symmetry continues:

$$D_\nu = \partial_\nu + i\sqrt{\lambda_2/\lambda_0}\psi^-, \quad D^\nu = \partial^\nu - i\sqrt{\lambda_2/\lambda_0}\psi^+ \tag{915}$$

c) Entangling with the spontaneous breaking (the off-diagonal elements), the explicit force (the diagonal components) is further emerged into the next horizon of a $SU(3)$ regime:

$$\check{\mathscr{L}}^{-SU3}_{Force} = \kappa_f\left(\lambda_0\partial^\nu\varphi^+_n\partial_\nu\phi^-_n - m^2\phi^2_n + \lambda_2\phi^2_n\psi^2_n\right) \tag{9.16}$$

where κ_f is a constant and $\phi^2_n = \varphi^+_n\phi^-_n$ or $\psi^2_n = \psi^+_n\psi^-_n$ is a density of the breaking fields, and d) With the gauge invariance (9.9) among the particle fields $\phi_n \mapsto (v + \phi^a_n + i\phi^b_n)/\sqrt{2}$, the strong force can be eventually developed into *Higgs* field, theorized in 1964 [19], and *Yukawa* interaction, introduced in 1935 [20].

Finally, we have landed at the classical *QCD* with the field breaking of forces interactions crossing the multiple horizons, and unified fundamentals of the known natural forces: electromagnetism, weak, strong and torque generators (graviton).

X. ELECTROMAGNETISM

Electromagnetic fields are a set of partial differential equations that form the foundation of classical electromagnetism. Obeying the Y^-Y^+ invariances, we have the invariance of the forces and continuities of the entangling streaming.

At the Y^- supremacy, equation (8.5) contains only one off-diagonal matrix $\check{\partial}^\lambda\check{\partial}_\lambda$. It implies the off-diagonal elements be conserved to zero $\mathbf{O}^- = 0$, and results in the invariance of the electromagnetic forces:

$$\check{\partial}_\lambda\left(\check{F}^{+n}_{m\alpha}\right)_\times = 0 \tag{10.1}$$

Simultaneously, for the off-diagonal elements (9.2) $\hat{\mathscr{L}}^-_\times = 0$, we acquire the continuity equation of the bispinor field:

$$ec\bar{\phi}_n\gamma_\nu\partial_\nu\varphi^-_n = \check{\partial}_\lambda\hat{F}^{-n}_{\nu\mu} \qquad : e\bar{\phi}_n = \frac{2c}{\hbar}\phi^+_n,\ \check{\partial}_\nu \mapsto c\partial_\nu \tag{10.2}$$

where $\bar{\phi}_n$ is known as *Dirac* adjoint and e is a coupling constant of the bispinor field. Therefore, it gives rise to the *Dirac* equation interrupting with the charged particles by means of an exchange of photons.

Artifact 10.1: Invariance of Electromagnetic Forces. From the equation (10.1), it derives the invariance of the symmetric forces as the following expressions:

$$(\mathbf{u}\nabla)\cdot\mathbf{B}^-_q = 0 \tag{10.3}$$

$$\frac{\partial\mathbf{B}^-_q}{\partial t} + \left(\frac{\mathbf{u}}{c}\nabla\right)\times\mathbf{E}^-_q = 0 \tag{10.4}$$

The magnetic field $\mathbf{B}^-_q$ in space is subject to time virtually associated with its physical opponent of electric field $\mathbf{E}^-_q$ such that, together, they serves as commutative resources, entangling between the dual manifolds and balanced by massless waves at light speed.

Artifact 10.2: Continuity of Electromagnetic Dynamics. At the event $\lambda = t$, the formula (10.2) in form of the Y^+ vector (7.12) is balanced with the four-vector density currents $\mathbf{O}^+ = \{\rho_q\mathbf{u}, \mathbf{J}_q\}$, equivalent to $\check{\partial}_\lambda\hat{F}^{-n}_{\nu\mu} = \mathbf{O}^+$:

$$\check{\partial}_\lambda\hat{F}^{-n}_{\nu\mu} = -\left(ic\frac{\partial}{\partial x_0}\quad \mathbf{u}\nabla\right)\begin{pmatrix}0 & \mathbf{D}^+_q\\ -\mathbf{D}^+_q & \frac{\mathbf{u}}{c^2}\times\mathbf{H}^+_q\end{pmatrix} = \begin{pmatrix}\mathbf{u}\rho_q\\ \mathbf{J}_q\end{pmatrix} \tag{10.5}$$

$$\rho_q\mathbf{u} = ec\bar{\phi}_n\gamma_0\partial_\kappa\varphi^-_n \qquad \mathbf{J}_q = ec\bar{\phi}_n\gamma_r\partial_r\phi^+_n \tag{10.6}$$

These formulae represent a set of the field equations:

$$(\mathbf{u}\nabla)\cdot\mathbf{D}^+_q = \mathbf{u}\rho_q \tag{10.7}$$

$$\frac{\mathbf{u}\cdot\mathbf{u}}{c^2}\nabla\times\mathbf{H}^+_q - \frac{\partial\mathbf{D}^+_q}{\partial t} = \mathbf{J}_q + \mathbf{H}^+_q\cdot\left(\frac{\mathbf{u}}{c}\nabla\right)\times\frac{\mathbf{u}}{c} \tag{10.8}$$

where the formula, $\nabla\cdot(\mathbf{u}\times\mathbf{H}) = \mathbf{H}\cdot(\nabla\times\mathbf{u}) - \mathbf{u}\cdot(\nabla\times\mathbf{H})$, is applied. Therefore, the charged particles under the Y^+ supremacy generate *Electric Displacing* $\mathbf{D}^+_q$ and *Magnetic Polarizing* $\mathbf{H}^+_q$ fields, which are balanced by the physical resources $\{\mathbf{u}\rho_q, \mathbf{J}_q\}$.

Artifact 10.3: Maxwell's Equations. At the constant speed c, the above equations emerge in a set of classical equations:

$$\nabla\cdot\mathbf{B}_q = 0 \tag{10.9}$$

$$\nabla\cdot\mathbf{D}_q = \rho_q \tag{10.10}$$

$$\nabla\times\mathbf{E}_q + \frac{\partial\mathbf{B}_q}{\partial t} = 0 \tag{10.11}$$

$$\nabla\times\mathbf{H}_q - \frac{\partial\mathbf{D}_q}{\partial t} = \mathbf{J}_q \tag{10.12}$$

known as *Maxwell's Equations*, discovered in 1820s [26]. Therefore, as the foundation, the quantum fields give rise to classical electromagnetism, describing how electric and magnetic fields are generated by charges, currents, and interactions. One important consequence of the equations is that they demonstrate how fluctuating electric and magnetic fields propagate at the speed of light.

Artifact 10.4: Lorenz Gauge. Imposing the vector potential field of $\hat{\partial}^\lambda A_\nu = \hat{F}^{-n}_{\nu\mu}$, the equation (10.2) becomes a wave function of the potential A_ν field:

$$-\frac{1}{c^2}\frac{\partial^2 A_\nu}{\partial t^2} + \nabla^2 A_\nu = \frac{e}{c}\bar{\phi}_n\gamma^\nu\hat{\partial}^\lambda\varphi^-_n \quad : \check{\partial}_\lambda\hat{\partial}^\lambda A_\nu = \check{\partial}_\lambda\hat{F}^{-n}_{\nu\mu} \tag{10.13}$$

known as *Lorenz* gauge [21] fixing the vector potential. It might be worthwhile to notice that the factor 2 in the adjoint potential $\bar{\phi}_n$ implies there exist two fields ($A_\nu \mapsto A^\pm_\nu$) as a duality of the entanglements, persistently.

Artifact 10.5: Electrostatic Force. Taking a spherical surface in the integral form of (10.10) to be a radius r, centered at the point charge Q, we have the following formulae in a free space:

$$\mathbf{E}(\mathbf{r}) = \frac{Q}{4\pi\varepsilon_0}\frac{\hat{\mathbf{r}}}{r^2} \qquad \mathbf{F}(\mathbf{r}) = q\mathbf{E}(\mathbf{r}) \tag{10.14}$$

known as Coulomb's force, discovered in 1784 [24]. An electric force may be either attractive or repulsive, depending on the signs of the charges.

CONCLUSION

Complying with classical and contemporary physics, this universal and unified theory demonstrates its holistic foundations applicable to the well-known natural intrinsics of the following remarks:

1) ***Entangle Generator*** is a transform process that acquires the empirical formulae of, but not limited to, *Lorentz* generators, *Pauli* spin matrices, torque gravitation, and transformational structures of symmetric fields.

2) ***Stateful Einstein mass-energy*** is refined philosophically as the entanglements of complex states with virtual imaginary interpretations $E_n^{\mp} = \pm\, i m c^2$.

3) ***Lagrangian density*** $\mathscr{L}$ is concisely redefined philosophically as the entanglements of continuity (9.1, 9.2) dynamically balanced between the manifolds.

4) ***Law of Conservation of Light***. For the first time, the law of light is revealed in the comprehensive integrity and characteristics of photon beyond its well-known nature at a constant speed.

5) ***Quantum Physics*** is derived as the compliance to contemporary physics and particle physics, testified by the empirical theories of *Schrödinger* and *Dirac* equations, *Quantum Electrodynamics*.

6) ***Field Breaking*** is introduced that constitutes the horizon forces of *Spontaneous Breaking*, *Explicit Breaking* and *Gauge Invariance*. It reveals the laws of the asymmetric processes of virtual creations and physical reproductions that give rise to a synergy of the weak, strong and medium forces crossing the horizon regimes, systematically, simultaneously and symmetrically. The theory is further illustrated by the artifacts of *Yang-Mills* actions, *Quantum Chromodynamics* and the weak and strong forces of *Standard Model*.

7) ***Maxwell's Equations*** is derived and unified by a set of generic field equations $\check{\partial}_\lambda(\check{F}^{+n}_{m\alpha})_\times = 0$ and $\check{\partial}_\lambda \hat{F}^{-n}_{\nu\mu} = (\mathbf{u}\rho_q \quad \mathbf{J}_q)$, rising from the quantum fields.

Consequently, this manuscript has testified to theoretical foundations of the *Universal Topology*, mathematical framework, event operations, and world equations [1] towards a unified physics...

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