«**Universal and Unified Field Theory**»

2. Entangle Generators, Quantum Physics, Conservation of Light and Standard Model

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Abstract: Harnessed with the *Universal Topology, Mathematical Framework* and *Universal Field Equations*, the applications to contemporary physics demonstrate and derive concisely, but are not limited to, a) ***Special Relativity of Entangle Generators***, b) ***General Formulation of Lagrangians***, c) ***Quantum Electrodynamics*** and ***Chromodynamics***, d) ***Law of Conservation of Light***, and e) ***Particle Physics***. *Consequently,* this unified theory testifies and complies precisely with the empirical physics of *Lorentz Generators*, *Pauli* matrices, *Planck* wave-energy and *Einstein* mass-energy equivalence, *Conservation of Energy-Momentum, Schrödinger* and *Dirac Equations, Pauli Weyl* Spinor Fields*, QED Lagrangian*, *Yang-Mille* theory, *Standard Model*, *Gauge Theory*, and others.

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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) and (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 [1] dawning at special relativity, photon of lights, and quantum mechanics, and consistently landing on quantum electrodynamics, chromodynamics and electromagnetism.

VII. ENTANGLE GENERATORS

As a part of the *Universal Topology*, the communication infrastructure between the manifolds are empowered with the speed of light $\check{\partial}_t x_m = (ic, c\check{\mathbf{b}})$ and $\hat{\partial}^t x^\mu = (-ic, c\hat{\mathbf{b}})$ 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.

Artifact 7.1: 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:

$$J^+_\mu = L_\mu - i\,K_\mu \qquad\qquad J^-_m = L_m + i\,K_m \tag{7.1}$$

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

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

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_x and L_x).

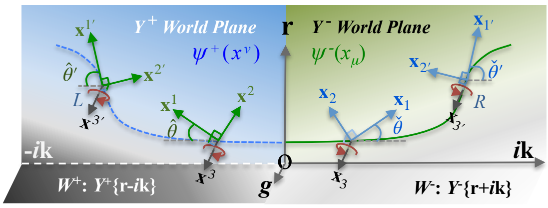

Figure 7.1: The Left- and Right-handed World Planes

Artifact 7.2: 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. In order to natively align with the two world planes of $Y^- : \check{x}\{\mathbf{r} + \mathbf{k}\}$ and $Y^+ : \hat{x}\{\mathbf{r} - \mathbf{k}\}$, it may be convenient to choose the three-dimensions of Cartesian coordinate system $\{\mathbf{x}_1, \mathbf{x}_2, \mathbf{x}_3\}$ in an orthogonal coordinate system such that the $\{\mathbf{x}_3\}$-axis is oriented parallel to the $\mathbf{g}(\lambda)$-axis of the global environment: $\mathbf{x}_3 || \mathbf{g}$, shown by Figure 7.1. In this matter of convention, when moving on the line of the world plane$\{\mathbf{k}, \mathbf{r}\}$, the $\mathbf{x}_3$-axis always passes through the center of the object and maintains the $\{\mathbf{x}_1, \mathbf{x}_2\}$ plane of the spacial coordinates parallel to each world planes $\{\pm\mathbf{k}, \mathbf{r}\}$. 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:

$$\phi^-(\check{x}) = S(\Lambda^+)\,\phi^+\left((\Lambda^+)^{-1}\check{x}\right) \qquad : \check{x} = \Lambda^+\hat{x}, \hat{x} = \Lambda^-\check{x} \tag{7.4}$$

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

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

where σ_κ are known as *Pauli* spin matrices, introduced in 1925 [11]. In chiral representation, the σ_κ indexes of $\{0{,}3\}$ are the diagonal elements of the matrix for a homogeneous environment. The indexes $\{0{,}1{,}2\}$ define each of the rotational axes of the spatial dimensions under the tetrad-coordinates. The indexes $\{1{,}2\}$ form a reciprocator to the $\{0{,}3\}$ matrices. Intuitively simplified to a group of the 2x2 matrixes, the generators have the following commutation relationships:

$$\sigma_a\sigma_b - \sigma_b\sigma_a = 0 \qquad \sigma_a\sigma_b + \sigma_b\sigma_a = 2i\,\varepsilon^+_{abc}\sigma_c \quad : a, b, c \neq 3 \tag{7.7}$$

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 $\mathbf{r}$ dimension ($I_r \mapsto 1$). 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, bringing the natural meanings into the Pauli matrices, discovered in 1926 [4].

Artifact 7.3: 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 7.4: ***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:

$$\check{F}^{-n}_{m\alpha} = \frac{\hbar}{E^-_n}\varphi^+_n \dot{x}^\alpha J^-_{m\alpha}\partial_m \phi^-_n \qquad \check{F}^{+n}_{m\alpha} = \frac{\hbar}{E^+_n}\phi^-_n \dot{x}_\alpha J^+_{m\alpha}\partial^m \varphi^+_n \tag{7.8}$$

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

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

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: $\check{F}^{+n}_{m\alpha} = -\check{F}^{-n}_{m\alpha}$ and embeds a pair of the antisymmetric matrix as a foundational structure, giving rise to a foundation of the magnetic ($\beta^a \mapsto \mathbf{B}^+_q$) and electric ($e^\nu \mapsto \mathbf{E}^+_q$) fields.

Artifact 7.5: ***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 equations:

$$\hat{F}^{+n}_{\nu\alpha} = \frac{\hbar}{E^+_n}\varphi^-_n \dot{x}_a J^+_{\nu\alpha}\partial^\nu \phi^+_n \qquad \hat{F}^{-n}_{\nu\alpha} = \frac{\hbar}{E^-_n}\phi^+_n \dot{x}^\alpha J^-_{\nu\alpha}\partial_\nu \varphi^-_n \tag{7.11}$$

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

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

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 $\hat{F}^{-n}_{\nu\alpha} = -\hat{F}^{+n}_{\nu\alpha}$, giving rise to the displacement $d_\alpha \mapsto \mathbf{D}^-_g$ and magnetizing $h_\nu \mapsto \mathbf{H}^-_g$ fields.

Artifact 7.6: 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 $J^\mp_{\mu a}$ of (7.8) and (7.11), *Spiral Torque* $K^\pm_{\mu a}$ generators naturally construct a pair of operational matrices that are also antisymmetric for elements in the 4x4 matrixes of the respective manifolds:

$$\check{T}^{-n}_{m\alpha} = \frac{\hbar}{E^-_n}\varphi^+_n \dot{x}^\alpha K^-_{m\alpha}\partial_m \phi^-_n \qquad \check{T}^{+n}_{m\alpha} = \frac{\hbar}{E^+_n}\phi^-_n \dot{x}_a K^+_{m\alpha}\partial^m \varphi^+_n \tag{7.14}$$

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

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

$$\hat{T}^{+n}_{m\alpha} = \frac{\hbar}{E^+_n}\varphi^-_n \dot{x}_a K^+_{m\alpha}\partial^m \phi^+_n \qquad \hat{T}^{-n}_{m\alpha} = \frac{\hbar}{E^-_n}\phi^+_n \dot{x}^\alpha K^-_{m\alpha}\partial_m \varphi^-_n \tag{7.17}$$

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

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

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 $W^\pm_n$, the (6.7) and (6.13) equations [1] can be reformulated into the compact forms for the Y^+ supremacy of the entanglements: *the Y^+ Quantum Equations*

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

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

$$\kappa_1 = \hbar c^2/2 \qquad \kappa_2 = \pm(\hbar c)^2/(2E^\mp_n) \qquad W^\pm_n = c^2 E^\mp_n \tag{8.3}$$

It emanates that the bi-directional transformation has two rotations one with left-handed $\phi^+_n \mapsto \phi^L_n$ pointing from the Y^+ source to the Y^- manifold, and the other with right-handed $\varphi^-_n \mapsto \phi^R_n$ 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 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 $\check{\partial}^\lambda$,
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 i) the antiparticles in a virtual world generate the physical particles through their opponent duality of the event operations; ii) by carrying and transitioning the informational massages, the antiparticles grow into more real-life objects in a physical world through their event operations; and iii) 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*

$$\frac{\hbar^2}{2E^-_n}\check{\partial}^\lambda\check{\partial}_\lambda\phi^-_n - \frac{\hbar}{2}\left(1 + \frac{\hbar}{E^-_n}\check{\partial}^\lambda\right)\left(\check{\partial}_\lambda - \hat{\partial}^\lambda\right)\phi^-_n = \frac{W^-_n}{c^2}\phi^-_n \tag{8.4}$$

$$\frac{-\hbar^2}{2E^+_n}\hat{\partial}^\lambda\hat{\partial}^\lambda\varphi^+_n - \frac{\hbar}{2}\left(1 - \frac{\hbar}{E^+_n}\check{\partial}^\lambda\right)\left(\hat{\partial}^\lambda - \check{\partial}_\lambda\right)\varphi^+_n = \frac{W^+_n}{c^2}\varphi^+_n \tag{8.5}$$

The Y^- parallel entanglement represents the essential principles of Y^- natural behaviors - ***Law 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:

$$\hat{\mathscr{L}}^+ = \frac{-\hbar^2}{2E_n^+E_n^-}\varphi^-\left(\hat{\partial}_\lambda\hat{\partial}_\lambda + \check{\partial}^\lambda\check{\partial}^\lambda\right)\phi^+ \tag{8.6a}$$

$$\hat{\mathscr{L}}^- = \frac{-\hbar^2}{2E_n^+E_n^-}\phi^+\left(\check{\partial}^\lambda\check{\partial}^\lambda + \hat{\partial}_\lambda\hat{\partial}_\lambda\right)\varphi^- \tag{8.6b}$$

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:

$$E_n^\mp = \pm imc^2 \qquad : \hbar\omega \rightleftharpoons mc^2 \tag{8.7}$$

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 formulae as one of the essentials of the topological manifolds.

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 ∂ only, we have (8.1)-(8.2) in the simple components:

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

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

$$2c\gamma^\mu\partial^\mu = \dot{x}^\alpha J^-_{\mu\alpha}\partial_\mu - \dot{x}_a J^+_{\mu a}\partial^\mu \qquad : \gamma_\mu\partial_\mu = -\gamma^\mu\partial^\mu \tag{8.9}$$

$$\left(i\hbar\gamma^\mu\partial^\mu + mc\right)\phi_n^+ = 0, \qquad \left(i\hbar\gamma_\nu\partial_\nu - mc\right)\varphi_n^- = 0 \tag{8.10}$$

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.

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

$$\phi_n^R = exp\left\{\frac{1}{2}\left(\sigma_k\check{\theta}_k - i\sigma_m\check{\theta}_m\right)\right\}\varphi_n^- \quad : (\phi_n^R)^{-1}\gamma^\mu\phi_n^R = \Lambda^+\gamma^\nu \tag{8.12}$$

$$\gamma^0 = \begin{pmatrix} 0 & I_2 \\ I_2 & 0 \end{pmatrix}, \ \gamma^\kappa = \begin{pmatrix} 0 & \sigma_\kappa \\ -\sigma_\kappa & 0 \end{pmatrix} \qquad : \gamma^\kappa\gamma^\kappa = I \tag{8.13}$$

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 $\check{\theta}_i \rightarrow -\hat{\theta}_i$ 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:

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

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

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

$$i\hbar\frac{\partial\phi_n^-}{\partial t} + \frac{\hbar^2}{2m}\frac{\partial^2\phi_n^-}{c^2\partial t^2} - \frac{\hbar^2}{2m}\nabla^2\phi_n^- = -\check{V}(\mathbf{r}, t_0)\phi_n^- \tag{8.15}$$

$$i\hbar\frac{\partial\varphi_n^+}{\partial t} - \frac{\hbar^2}{2m}\frac{\partial^2\varphi_n^+}{c^2\partial t^2} + \frac{\hbar^2}{2m}\nabla^2\varphi_n^+ = \hat{V}(\mathbf{r}, t_0)\varphi_n^+ \tag{8.16}$$

where m is the rest mass. For the first order of time evolution, it emerges as *Schrödinger* equation, introduced in 1926 [6]:

$$i\hbar\frac{\partial\psi_n}{\partial t} = \hat{H}\psi_n \qquad : \hat{H} \equiv -\frac{\hbar^2}{2m}\nabla^2 + \hat{V}(\mathbf{r}, t_0) \tag{8.17}$$

where $\hat{H}$ is the classical *Hamiltonian* operator, introduced in 1834 [4].

Artifact 8.7: Photon. Considering $\hat{\partial}^\lambda = -\sigma_3\check{\partial}_\lambda$ and $W_n^\mp = c^2E_n^\pm$, we convert equations (8.4) and (8.5) into the expressions:

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

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

For the boost transformations at constant speed c, it obeys time-invariance ($\check{\mathscr{L}}^{1H}_{Force} \mapsto 0$) at the first horizon:

$$\check{\mathscr{L}}^{1H}_{Force} = \varphi_n^+\frac{-\hbar^2}{2E_n^+}(I_2 + \sigma_3)\check{\partial}_\lambda\phi_n^- + \phi_n^-\frac{-\hbar^2}{2E_n^-}(I_2 + \sigma_3)\hat{\partial}^\lambda\varphi_n^+ \tag{8.20}$$

Adding (8.18) and (8.19) together, we derive a trace of the diagonalized tensors in forms of a wave equation at the event $\lambda = t$ and $\check{\mathscr{L}}^{1H}_{Force} = 0$:

$$-\frac{1}{c^2}\frac{\partial^2\Phi_n^-}{\partial t^2} + \nabla^2\Phi_n^- = 4\frac{E_n^-E_n^+}{(\hbar c)^2}\Phi_n^- \qquad : \Phi_n^- = \varphi_n^+\phi_n^- \tag{8.21}$$

The energy area flow, $4E_n^-E_n^+/(\hbar c)^2$, represents a pair of the irreducible units $E_n^\mp$ 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 *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 above equation presents a conservation of the 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:

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

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*: $W = P \pm iV$.

Artifact 8.9: Conservation of Light. The equations (8.10)-(8.21) state that, at a constant speed c, the light has the characteristics of:

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 (8.20), it also yields *Planck's* law in thermal equilibrium of entropy [4]:

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

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. The above equivalence results in a pair of the complex formulae:

$$E_c^\pm = \mp i\frac{1}{2}\hbar\omega_c \qquad : \eta_c = \pi^{-3} \approx 33\,\% \tag{8.24}$$

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. QUANTUM ELECTRO- AND CHROMO-DYNAMICS.

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

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

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

where the term, $\varphi_n^-\check\partial^\lambda\check\partial^\lambda\phi_n^+$, is mapped to the electromagnetic fields $\varphi_n^-\check\partial^\lambda\check\partial^\lambda\phi_n^+ = \varphi_n^-\check\partial^\lambda\phi_n^+\varphi_n^-\check\partial^\lambda\phi_n^+ \mapsto \hat F_{\mu\nu}^{-n}\hat F_{\mu\nu}^{-n} + \check\partial^\lambda\hat F_{\mu\nu}^{-n}$, where the horizon force $\check\partial^\lambda\hat F_{\mu\nu}^{-n}$ is consumed and balanced by an asymmetric force (20.3). As a pair of dynamics, it defines and generalizes a duality of *QED* for the entanglements among spins and electromagnetic fields.

Our primary goal is to bring together the original potentials and to acquire the root cause of the four known forces beyond the single variations of the *Lagrangian*. Apparently, the entangling states of the *Lagrangians* (9.1) and (9.2) establish the foundations to further extend the "pure" singlet into the field interactions (or equivalently "gauge" invariance) between doublets and among the triplets. Among the elementary particles, the four quantum fields (8.1)-(8.5) have embedded the ground foundation or intrinsics of field interactions of strong forces by coupling with the techniques of *Gauge* invariance.

Artifact 9.1: Continuity of Electrodynamics. Obeying the Y^-Y^+ invariance for the off-diagonal elements (9.2) $\mathscr{L}_\times^- = 0$, we acquire the continuity equation:

$$ec\bar\phi_n\gamma_\nu\partial_\nu\varphi_n^- = \check\partial_\lambda\hat F_{\nu\mu}^{-n} \qquad : e\bar\phi_n = \frac{2c}{\hbar}\phi_n^+, \check\partial_\nu \mapsto c\partial_\nu \tag{9.3}$$

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 9.2: Lorenz Gauge. Imposing the vector potential field of $\hat\partial^\lambda A_\nu = \hat F_{\nu\mu}^{-n}$, the equation (9.3) becomes a wave function of the potential A_ν field:

$$-\frac{1}{c^2}\frac{\partial^2 A_\nu}{\partial t^2} + \nabla^2 A_\nu = \frac{e}{c}\bar\phi_n\gamma^\nu\hat\partial^\lambda\varphi_n^- \qquad : \check\partial_\lambda\hat\partial^\lambda A_\nu = \check\partial_\lambda\hat F_{\nu\mu}^{-n} \tag{9.4}$$

known as *Lorenz* gauge [4] 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 ($A_\nu \mapsto A_\nu^\pm$) for the entanglements, persistently.

Artifact 9.3: Yang-Mills Theory. To observe the Y^- reactions with the field entanglements $\hat F_{\nu\mu}^{-n}\hat F_{\nu\mu}^{+n}$, we impose the formulation of triplet quarks $\hat{\mathscr{L}}^+ + 2\hat{\mathscr{L}}^-$ to the Y^+ (9.1) and Y^- (9.2) for the dual streaming $2\mathscr{L}_{QED} = \hat{\mathscr{L}}^+ + 2\hat{\mathscr{L}}^-$ and arrive at *Lagrangian QED* [14].

$$\mathscr{L}_{QED} = \bar\psi_n\Big(i\frac{\hbar}{c}\gamma_\nu\check\partial_\lambda - m\Big)\varphi_n^- - \frac{1}{4}\hat F_{\nu\mu}^{-n}\hat F_{\nu\mu}^{+n} \qquad : \bar\psi_n = \frac{c^2}{2iE_n^+}\phi_n^+ \tag{9.5}$$

where the term $\hat F_{\nu\mu}^{-n}\hat F_{\nu\mu}^{-n}/4$ is known as *Yang-Mills* actions, introduced in 1954. 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 predicted various properties of weak neutral currents and the W and Z bosons with great accuracy.

Artifact 9.4: Electroweak Fields. Because of the linear functions between $J_{m\alpha}^\pm$ and $K_{m\alpha}^\pm$ tensors, the *Spiral Torques* $K_{m\alpha}^\pm = \Gamma_{m\alpha}^{\pm s}x_s$ of equations (3.5) and (3.7) can be straightforwardly extended into (9.5), shown by the following expressions:

$$\hat{\mathscr{L}}_{WF} = \bar\psi_n\Big(i\hbar\gamma_\nu D_\nu - m\Big)\varphi_n^- - \frac{1}{4}\hat W_{\nu\mu}^{-n}\hat W_{\nu\mu}^{+n} - \frac{1}{4}\hat F_{\nu\mu}^{-n}\hat F_{\nu\mu}^{+n} \tag{9.6}$$

$$\hat W_{\nu\alpha}^{+n} = \frac{\hbar}{E_n^+}\varphi_n^-\dot x_a K_{\nu a}^+\partial^\nu\phi_n^+, \;\; \hat W_{\nu a}^{-n} = \frac{\hbar}{E_n^-}\phi_n^+\dot x^\alpha K_{\nu\alpha}^-\partial_\nu\varphi_n^- \tag{9.7}$$

where the *Torque* $K_{m\alpha}^\pm$ tensors generate the weak isospin field $\hat W_{\nu\mu}^{\pm a}$, while, simultaneously, *boost* $J_{m\alpha}^\pm$ tensors generate the hypercharge fields $\hat F_{\nu\mu}^{\pm n}$. Precisely, we extend the *Spiral Torque* fields $\hat F_{\nu\mu}^{\pm n} \mapsto \hat W_{\nu\mu}^{+n} + \hat F_{\nu\mu}^{+n}$ 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 9.5: 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 $\hat W_{\nu\mu}^{\pm a} + \hat F_{\nu\mu}^{\pm a} \mapsto G_{\nu\mu}^a$ to represent the *Standard Model* associated with gauge transformation:

$$\hat{\mathscr{L}}_{SD} = \bar\psi_n\Big(i\hbar\gamma_\nu D_\nu - m\Big)\varphi_n^- - \frac{1}{4}G_{\nu\mu}^n G_{\nu\mu}^n + \hat{\mathscr{L}}_{CP} \tag{9.8}$$

$$D_\nu = \partial_\nu + i\frac{e}{c}A_\nu, \;\; G_{\nu\mu}^a = \partial_\nu A_\mu^a - \partial_\mu A_\nu^a + gf^{abc}A_\nu^b A_\mu^c \tag{9.9}$$

where A_ν are the gluon fields, 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]. 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:

$$\hat{\mathscr{L}}_{CP} = -\bar\psi_n\gamma^\mu\left(ig_s G_\mu^a T_{ij}^a\right)\varphi_n^- \mapsto \hat{\mathscr{L}}_{ST} \tag{9.10}$$

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

Artifact 9.6: Field Interactions. Parallel to *Dirac* matrix (8.9) given by *Lorentz Generators* (7.4), *Spiral Torques* $K_{m\alpha}^\pm$ (3.5) and (3.7) create the generator χ^μ to couple with the gauge field B_μ in the first horizon U(1).

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

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

$$\hat{\mathscr{L}}_{CP} = -\bar\psi_n\gamma^\mu\left(g'\tfrac{1}{2}Y_W B_\mu + g\tfrac{1}{2}\sigma_\nu W_{\nu\mu}\right)\varphi_n^- \mapsto \mathscr{L}_{EW} \tag{9.12}$$

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 is the SU(2) coupling constant.

Artifact 9.7: Y^+ Strong Interactions. G*iving rise to* the horizon SU(2), the (8.20, 8-21) function as the classic *Lagrangian* and extend $\overrightarrow{\varphi}_n^+ \mapsto \varphi_n^+ - \sqrt{\lambda_0}D^\nu\varphi_n^+/m$ and $\overrightarrow{\phi}_n^- \mapsto \phi_n^- + \sqrt{\lambda_0}D_\nu\phi_n^-/m$ to the form of:

$$\check{\mathscr{L}}_{Force}^{2H} \propto -4\frac{E_n^- E_n^+}{(\hbar c)^2}\overrightarrow{\varphi}_n^+\overrightarrow{\phi}_n^- \mapsto \lambda_0 D^\nu\varphi_n^+ D_\nu\phi_n^- - m^2\varphi_n^+\phi_n^- \tag{9.13}$$

From spontaneous breaking of gauge symmetry $D_\nu = \partial_\nu + i\sqrt{\lambda_2}\psi^-$ and $D^\nu = \partial^\nu - i\sqrt{\lambda_2}\psi^+$, the second horizon develops the next SU(3) forces:

$$\check{\mathscr{L}}_{Force}^{3H} = \kappa_f\sum\nolimits_n\left(\lambda_0\partial^\nu\varphi_n^+\partial_\nu\phi_n^- - m^2\phi_n^2 + \lambda_2\phi_n^2\psi_n^2\right) \tag{9.14}$$

where κ_f is a constant, $\phi_n^2 = \varphi_n^+\phi_n^-$ and $\psi_n^2 = \psi_n^+\psi_n^-$. With the gauge invariance (9.9) and $\phi_n \mapsto (v + \phi_n^a + i\phi_n^b)/\sqrt{2}$, the strong force can be further developed into *Higgs* field, theorized in 1964 [19], and *Yukawa* interaction, introduced in 1935 [20].

In general, the weak and strong forces are characterizable and distinguishable under each scope of the horizons for its mathematical interpretations, respectively:

1. A weak force is among the dynamic interruptions under the Y^+ supremacy: $\{\phi_n^+, \varphi_n^-\}$, dominated by the off-diagonal elements of the field tensors.
2. As a natural duality, a stronger force is among the dynamic interruptions under the Y^- supremacy: $\{\phi_n^-, \varphi_n^+\}$, dominated by the diagonal elements of the field tensors.
3. Apparently, given rise by the higher horizon (3.9)-(3.10) or classically known as *Gauge Theory*, the interactive forces define the simple symmetry group U(1) × SU(2) in *Standard Model*.
4. Furthermore, an integrity of the strong nuclear forces is characterizable at the third horizon of the tangent vector interactions (9.14) or known as gauge SU(3).

Finally, we have landed at the classic *QCD* and *Force* interactions, which unifies description of the known fundamental natural forces: electromagnetism, weak, strong and torque generators (graviton).

X. ELECTROMAGNETISM

At the event $\lambda = t$, the formula (9.3) in the form of the Y^+ vector (7.12) is balanced with the four-vector density currents $\{\rho_q \mathbf{u}, \mathbf{J}_q\}$, equivalent to $\check{\partial}_\lambda \hat{F}_{\nu\mu}^{-n} = (\mathbf{u}\rho_q \quad \mathbf{J}_q)$:

$$\check{\partial}_\lambda \hat{F}_{\nu\mu}^{-n} = -\left(ic\frac{\partial}{\partial x_0} \quad \mathbf{u}\nabla\right)\begin{pmatrix} 0 & \mathbf{D}_q^+ \\ -\mathbf{D}_q^+ & \frac{\mathbf{u}}{c^2}\times\mathbf{H}_q^+ \end{pmatrix} = \begin{pmatrix} \mathbf{u}\rho_q \\ \mathbf{J}_q \end{pmatrix} \quad (10.1a)$$

$$\rho_q \mathbf{u} = ec\bar{\phi}_n \gamma_0 \partial_\kappa \varphi_n^- \qquad \mathbf{J}_q = ec\bar{\phi}_n \gamma_r \partial_r \phi_n^+ \quad (10.2)$$

These formulae represent a set of the field equations:

$$(\mathbf{u}\nabla)\cdot\mathbf{D}_q^+ = \mathbf{u}\rho_q \quad : \quad (10.3)$$

$$\frac{\mathbf{u}\cdot\mathbf{u}}{c^2}\nabla\times\mathbf{H}_q^+ - \frac{\partial\mathbf{D}_q^+}{\partial t} = \mathbf{J}_q + \mathbf{H}_q^+\cdot\left(\frac{\mathbf{u}}{c}\nabla\right)\times\frac{\mathbf{u}}{c} \quad (10.4)$$

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 $\{\mathbf{u}\rho_q, \mathbf{J}_q\}$.

Simultaneously 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, and results in the continuity equation of

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

$$(\mathbf{u}\nabla)\cdot\mathbf{B}_q^- = 0 \quad (10.5)$$

$$\frac{\partial\mathbf{B}_q^-}{\partial t} + \left(\frac{\mathbf{u}}{c}\nabla\right)\times\mathbf{E}_q^- = 0 \quad (10.6)$$

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

$$\nabla\cdot\mathbf{B}_q = 0 \quad (10.7)$$

$$\nabla\cdot\mathbf{D}_q = \rho_q \quad (10.8)$$

$$\nabla\times\mathbf{E}_q + \frac{\partial\mathbf{B}_q}{\partial t} = 0 \quad (10.9)$$

$$\nabla\times\mathbf{H}_q - \frac{\partial\mathbf{D}_q}{\partial t} = \mathbf{J}_q \quad (10.10)$$

known as *Maxwell's Equations*, discovered in 1820s. 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.

CONCLUSION

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

1) As evolutionary process, the theory acquires the empirical formulae of, but not limited to, *Lorentz* generators, *Pauli* spin matrices, torque gravitation, and transformational field structures.

2) *Einstein mass-energy* and *Lagrangian density* $\mathscr{L}$ are refined philosophically as the entanglements of complex (8.7) and continuity (9.1)-(9.2) dynamically balanced between the manifolds.

3) ***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.

4) ***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*, *Lorenz Gauge, Yang-Mills* actions, and *Quantum Chromodynamics*, including the weak and strong forces theorized by *Standard Model* and gauge invariance.

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

REFERENCES

1. Xu, Wei (2017) 《Universal and Unified Field Theory》 1. Topological Framework, World Equations and Universal Fields. viXra:1709.0308
2. Bourbaki, N. (1989). Lie Groups and Lie Algebras: Chapters 1-3. Berlin·Heidelberg·New York: Springer. ISBN 978-3-540-64242-8.
3. William O. Straub, (2017) "A Child's Guide to Spinors" viXra:1701.0299
4. Schiff, Leonard I. (1968). "Quantum Mechanics. McGraw-Hill" ISBN 978-0070552876.
5. Levi-Civita, Tullio (1917), "Nozione di parallelismo in una varietà qualunque", Rendiconti del Circolo Matematico di Palermo (in Italian), 42: 173–205, JFM 46.1125.02, doi:10.1007/BF03014898.
6. Schrödinger, E. (1926). "An Undulatory Theory of the Mechanics of Atoms and Molecules" (PDF). Physical Review. 28 (6): 1049–1070.
7. Dirac, P.A.M. (1982) [1958]. Principles of Quantum Mechanics. International Series of Monographs on Physics (4th ed.). Oxford University Press. p. 255. ISBN 978-0-19-852011-5
8. W. K. Clifford, "Preliminary sketch of bi-quaternions, Proc. London Math. Soc. Vol. 4 (1873) pp. 381–395.
9. Planck, Max (1901), "Ueber das Gesetz der Energieverteilung im Normalspectrum" (PDF), Ann. Phys., 309 (3): 553–63.
10. Einstein, A. (1905), "Ist die Trägheit eines Körpers von seinem Energieinhalt abhängig?", Annalen der Physik, 18: 639–643, Bibcode: 1905AnP...323..639E, doi:10.1002/andp.19053231314.
11. Wolfgang Pauli (1927) Zur Quantenmechanik des magnetischen Elektrons Zeitschrift für Physik (43) 601-623
12. Weyl, Hermann (1939), The Classical Groups. Their Invariants and Representations, Princeton University Press, ISBN 978-0-691-05756-9
13. Dirac, P.A.M. (1927). "The Quantum Theory of the Emission and Absorption of Radiation". Proceedings of the Royal Society of London A. 114 (767): 243–65
14. Yang, C. N.; Mills, R. (1954). "Conservation of Isotopic Spin and Isotopic Gauge Invariance". Physical Review. 96 (1): 191–195.
15. H.D. Politzer (1973). "Reliable perturbative results for strong interactions". Physical Review Letters. 30 (26): 1346–1349.
16. Augustin, J.; et al. (1974). "Discovery of a Narrow Resonance in e+e− Annihilation". Physical Review Letters. 33 (23): 1406–1408.
17. S.L. Glashow (1961). "Partial-symmetries of weak interactions". Nuclear Physics. 22 (4): 579–588.
18. Gell-Mann, M. (1962). "Symmetries of baryons and mesons" Physical Review 125 (3) 1067.
19. Higgs, Peter 1964. Broken symmetries and the masses of gauge bosons. Physical Review Letters 13 (16): 508–509.
20. H. Yukawa, Proc. Phys.-Math. Soc. Jap. 17 (1985), 48.