2. Quantum Physics, Conservation of Light and Standard Model of Particle Physics

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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 is testified and complying precisely with the empirical physics of Lorentz Generators, Pauli matrices, General Relativity, 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 the others.

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

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INTRODUCTION

The main objective of this manuscript is to clearly demonstrate that, under Universal Topology $W = P \pm i V$ [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 among relativistic transformations, conducting laws of evolutions and conservations, and maintaining field entanglements of week 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 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 $\delta x_a = |i c, b|$ and $\partial x^a = \{−i, c, b\}$ that the transform and transport have axiomatic communications or entanglements for the event operations, informational transmissions or conveyable actions. Between the world planes, the two-dimensional transportations [$x \equiv |k|$] 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 8.1: Transport Generators. From the matrices (3.5) $J^{\mu}_p = \partial x^a \partial x^a$ and (3.7) $J^{\mu}_a = \partial x^a \partial x^a$ [1], the Inertial Boosts $J^{\mu}_a$ can naturally come out a pair of generators as the explicit matrix tables:

\[
J^{\mu}_p = L_p + iK_p = L_a + iK_a \quad \text{(7.1)}
\]

\[
K_3 = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix}, \quad K_2 = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix}, \quad K_1 = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{pmatrix} \quad \text{(7.2)}
\]

\[
L_4 = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad L_3 = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}, \quad L_2 = \begin{pmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \quad \text{(7.3)}
\]

This is similar to and known as Lorentz Generators, discovered since 1892 [3].

Artifact 8.2: 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 $\{\pm k, r\}$ world planes, it may be convenient to choose the three-dimensions of Cartesian coordinate system $\{x_1, x_2, x_3\}$ in an orthogonal coordinate system such that the $x_1$-axis is oriented parallel to the $\Omega^i$-axis of the global environment: $x_1 | g_0$, shown by Figure 7.1. In this matter of convention, when moving on the line of the world plane $[k, r]$, the $x_1$-axis always passes through the center of the object and maintains the $[x_1, x_3]$ plane of the special coordinates parallel to the global $[\pm k, r]$ plane.

Following the modulation, an inertial movement on the global $[k, r]$ world plane of the $Y'$ manifold is natively applied to the spatial $[x_1, x_3]$ plane with an additional right-handed rotations $\theta$ or $\bar{\theta}$. Meanwhile, the $[x_1, x_3]$ coordinates associated with the $Y'$ manifold is simply a mirror or reciprocal image of the left-handed rotation $\theta$ or $\bar{\theta}$. As a consequence, the $Y'Y^+$ generators (7.1) can be expressed by the two-dimensional world planes $[r \mp |k|]$ with their extensions into the spacial $r$ dimensions, shown by the 2x2 matrices:

\[
J^r = \begin{pmatrix} \sigma_0 & i \sigma_1 \\ \sigma_3 & i \sigma_2 \end{pmatrix} \quad \text{(7.4)}
\]

\[
\sigma_0 = \begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}, \quad \sigma_1 = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \quad \sigma_2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \quad \sigma_3 = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \text{(7.5)}
\]

known as Pauli spin $\sigma_0$ matrices, introduced in 1925 [11]. The $\sigma_i$ 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 non-zero dimensions under the tetrad-coordinates. The indexes $[1,2]$ form a reciprocal to the $[0,3]$ matrices. Intuitively simplified to a group of the 2x2 matrices, the generators have the following commutation relationships:

\[
\sigma_0 \sigma_1 - \sigma_1 \sigma_0 = 0 \quad \sigma_0 \sigma_2 + \sigma_2 \sigma_0 = 2i \sigma_3 \sigma_1 \quad \text{: a, b, c } \neq 3 \quad \text{(7.6)}
\]

\[
J^rJ^r = 2(\sigma_0 + \sigma_3), \quad J^rJ^r = 2(\sigma_1 - \sigma_2), \quad \sigma_3^2 = \sigma_3 \quad \text{(7.7)}
\]

In accordance with our anticipation, the zero commutator illustrates the distinct freedoms of physical supremacy that are degradation ($\sigma^2 = \sigma_3$) back to the global $r$ dimension $(l \rightarrow 1)$. With the left-handed $\sigma_3$ 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 8.3: Chiral Entanglement. The interpretations of Figure 8.1 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 entanglement 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 total

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

* * *

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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 8.4: Y⁻ Transform Fields.** As the function quantity, 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 entanglements:

\[
F_{\alpha\beta} = \frac{e}{E_n} \phi^{\alpha} \pi^\lambda J_{\mu} a_\mu a_\nu \phi^\nu (7.8)
\]

\[
F_{\mu\nu} = \frac{e}{E_n} \phi^{\alpha} \nabla_\mu a_\nu \phi^\nu (7.9)
\]

where the \( \hat{b} \) is a base vector and the symbol ( \( \lambda \) ) is the diagonal elements of the tensor and the Levi-Civita [5] connection \( \epsilon_{\lambda\mu\nu} \in \mathbb{Y} \) represents the left-hand chiral. At a constant speed, this Y⁻ Transform Tensor constructs a pair of its off-diagonal fields: \( F_{\alpha\beta} = - F_{\beta\alpha} \) and embeds a pair of the antisymmetric matrix as a foundational structure, giving rise to a foundation of the magnetic (\( \phi^\mu \rightarrow B^\lambda \)) and electric (\( \epsilon^\mu \rightarrow E^\lambda \)) fields.

**Artifact 8.5: Y⁺ Transform Fields.** In the parallel fashion of (7.8), the event processes generate the reciprocal entanglements of the Y⁺ commutation of the scalar \( \phi^\mu \) and field profiles, shown by the equations:

\[
F_{\lambda} = \frac{h}{E_n} \phi^{\mu} \pi^\nu J_{\beta} a_{\beta} \phi^\nu (7.10)
\]

where the Levi-Civita connection \( \epsilon_{\lambda\mu\nu} \) represents the right-hand chiral. At a constant speed, this Y⁺ Transport Tensor constructs another pair of off-diagonal fields: \( F_{\alpha\beta} = - F_{\beta\alpha} \) giving rise to the displacement \( d_{\mu} \rightarrow D_{\mu} \) and magnetizing \( h_{\alpha} \rightarrow H_{\alpha} \).

**Artifact 18.6: Spiral Torque Generators.** Because of the Y⁻ Y⁺ commutation infrastructure of rising horizontal, an event generates entanglements between the manifolds, and performs the operators of \( \phi^\mu \) and \( \partial_{\mu} \) transports the motion vectors of \( \pi^\lambda \) and \( \epsilon_{\lambda} \), and gives rise to the vector potentials of \( x^\mu \partial_{\mu} \pi^\lambda \) or \( \epsilon_{\lambda} \partial_{\mu} \pi^\lambda \) Parallel to the boost generators \( J_{\mu} \) of (7.8) and (7.11), Spiral Torque \( K_{\mu} \) naturally constructs a pair of operational matrices that are also antisymmetric elements for the 4x4 matrix of the respective manifolds:

\[
\hat{F}_{\alpha\beta} = \frac{h}{E_n} \phi^{\mu} \pi^\nu J_{\beta} a_{\beta} \phi^\nu (7.14)
\]

At a constant speed, the **Torsion Tensors** construct two pairs of the off-diagonal fields: \( T_{\alpha\beta} = - T_{\beta\alpha} \) and embed the antisymmetric matrices as a foundational structure giving rise to i) a pair of the virtual motion stress (\( \pi \rightarrow \dot{B} \)) and physical twist torsion (\( \partial \rightarrow E \)) fields, and ii) another pair of the virtual displacement stress (\( \chi \rightarrow D^2 \)) and physical polarizing twist (\( \omega \rightarrow H^2 \)) fields.

**VIII. QUANTUM MECHANICS**

At the first horizon, the individual behaviors of objects or particles are characterized by their time-state functions of \( \phi^\mu \) or \( \phi^\mu \) in the first W⁻ 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 \( W^\mu_n \), 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**

\[
-\frac{h}{2E_n} \dot{\phi}^\mu \dot{\phi}^\mu - \frac{\hbar}{2} (\hat{\phi}^\mu - \dot{\phi}^\mu) \phi^\mu + \frac{\hbar^2}{2E_n} \dot{\phi}^\mu \dot{\phi}^\mu = E^\mu \phi^\mu (8.1)
\]

\[
\frac{h}{2E_n} \dot{\phi}^\mu \dot{\phi}^\mu + \frac{\hbar}{2} (\hat{\phi}^\mu - \dot{\phi}^\mu) \phi^\mu + \frac{\hbar^2}{2E_n} \dot{\phi}^\mu \dot{\phi}^\mu = E^\mu \phi^\mu (8.2)
\]

It emulates that the bi-directional transformation has two rotations one with \( \phi^\mu \rightarrow \dot{\phi}^\mu \) pointing from the Y⁻ source to the Y⁺ manifold, and the other with right-handed \( \phi^\mu \rightarrow \dot{\phi}^\mu \) 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 \( \phi^\mu \) of virtual supremacy results in the physical effects as the parallel and reciprocal reactions or emanations \( \dot{\phi}^\mu \) in the physical world; and
2. The virtual world transports the effects \( \phi^\mu \rightarrow \hat{\phi}^\mu \) emerging into or appearing as the creations of the physical world, even though the bi-directional transformations seems balanced between the commutative operations of \( \dot{\phi}^\mu \) and \( \hat{\phi}^\mu \),
3. As a part of the reciprocal processes, the physical world transports the reactive effects \( \dot{\phi}^\mu \rightarrow \hat{\phi}^\mu \) 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 transitional 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 streamings.

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**

\[
-\frac{h}{2E_n} \dot{\phi}^\mu \dot{\phi}^\mu - \frac{\hbar}{2} (\hat{\phi}^\mu - \dot{\phi}^\mu) \phi^\mu + \frac{\hbar^2}{2E_n} \dot{\phi}^\mu \dot{\phi}^\mu = W^\mu \phi^\mu (8.4)
\]

**The Y⁺ Parallel entanglement represents the essential principles of Y⁻ natural behaviors - Law of Physical Animation and Reproduction**:

1. The operational action \( \phi^\mu \) of physical supremacy results in their conjugate or imaginary effects of animations because of the parallel reaction \( \phi^\mu \) in the virtual world;
2. Neither the actions nor reactions impose their final consequences \( \dot{\phi}^\mu \) to their opponents because of the
parallel mirroring residuals for the horizon phenomena of reproductions \( \partial^2 \phi^2 \) during the symmetric fluxes.

3. There are one-way commutations of \( \partial^2 \psi \) in transporting the events of the virtual world into the virtual world asymmetrically. As a part of the reciprocal processes, the virtual world replicates \( \partial^2 \psi \) the physical events during the mirroring \( \partial^2 \psi \) processes in the virtual world.

As another set of the 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 to 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 steering might become possible as a part of recycling or reciprocating a real-life in the physical world.

Artificial 8.1: Lagrangian of Entanglements. To seamlessly integrate with the classical dynamic equations, it is critical to interpret or recycle the natural meanings to Lagrangian mechanics \( \mathcal{L} \) in forms of the dual manifolds. As a function of the generalized information and formulation, Lagrangians \( \mathcal{L} \) can be redefined as a part of the continuities, entangling between the \( Y \to Y' \) manifolds respectively:

\[
\dot{\psi} = -i\frac{\hbar}{2m} \sigma_1 \psi, \quad \dot{\bar{\psi}} = i\frac{\hbar}{2m} \sigma_1 \bar{\psi}.
\]

(8.6)

The formulae generalize 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 \( Y \to Y' \) dynamic fields.

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

\[
E_{\text{m}} = \pm i mc^2 : \hbar c = mc^2
\]

(8.7)

Compliant with a duality of Universal Topology \( W \equiv P \pm i V \), it extends Einstein mass-energy equivalence, introduced in 1905 [10], into the virtual energy formulae as one of the essentials of the topological manifolds.

Artificial 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, reciprocity. Considering the first order \( \partial \) only, we have (8.1)-(8.2) in the simple components:

\[
\frac{\hbar}{2} \left( \partial_0 - \partial \right) \psi + \pm i E_{\text{m}} \psi = 0 : \psi = \left\{ \phi_+^*, \phi_-^* \right\}
\]

(8.8)

Because of the transformational characteristics \( \partial_0 = iJ_{\mu} \partial^\mu \) and \( \partial V = iJ_{\mu} \partial^\mu \), it can be reformulated into the compact equations:

\[
2c \gamma^\mu \partial^\mu = \frac{i}{\hbar} \left( \gamma^0 \gamma^1 \partial_0 + \gamma^1 \gamma^0 \partial_1 \right) \left( \pm i \gamma_{\text{m}} \right) \left( \partial_{\text{m}} \right) = -\gamma^0 \partial^0
\]

(8.9)

\[
\left( i\hbar \gamma^\mu \partial^\mu + mc \right) \phi_+^* = 0 \left( i\hbar \gamma^\mu \partial^\mu - mc \right) \phi_-^* = 0
\]

(8.10)

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

Artificial 8.4: Spinor Fields. From Spin Generators, the equations (7.4)-(7.5), the respective boost transformations of spinors are given straightforwardly by the matrices:

\[
\phi_+^* = \exp \left\{ \frac{i}{2} \left( \sigma_0 \partial_0 - i\sigma_1 \partial_1 \right) \right\} \phi_0^* \quad \phi_-^* = \exp \left\{ \frac{i}{2} \left( \sigma_0 \partial_0 + i\sigma_1 \partial_1 \right) \right\} \phi_0^*
\]

(8.11)

Each of the first terms is the formulation 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 \( \partial_0 \to \partial_1 \) for spin-up and spin-down positrons.

Artificial 8.5: Pauli and Weyl Matrices. In chiral representation, the matrix \( \gamma^\nu \), created by W. K. Clifford [8] in the 1870s, is given by:

\[
\gamma^0 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} : \gamma^0 \gamma^a = 1
\]

(8.12)

In the limit at \( m \to 0 \), the Dirac equation (8.10) is reduced to the massless particles:

\[
\sigma^a \phi_\nu = 0, \quad \frac{1}{c} \frac{\partial \psi}{\partial t} + \sigma_0 \frac{\partial \psi}{\partial x} + \sigma_1 \frac{\partial \psi}{\partial y} + \sigma_2 \frac{\partial \psi}{\partial z} = 0
\]

(8.14)

known as Weyl equation introduced in 1918 [12].

Artificial 8.6: Schrödinger Equation. For observations under an environment of \( W_2 = \pm i e^2 \), it is critical to interpret or recycle or reciprocating a real-life in the physical world.

\[
i \hbar \frac{\partial \psi^*}{\partial t} = \frac{\hbar^2}{2m} \left( \frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} + \frac{\partial^2 \phi}{\partial z^2} \right) + \psi = \psi
\]

(8.16)

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

\[
i \hbar \frac{\partial \psi}{\partial t} = \hat{H} \psi
\]

(8.17)

where \( H \) is the classical Hamiltonian operator, introduced in 1834 [4].

Artificial 8.7: Photon. Considering \( \sigma_3 = \sigma_1 \sigma_2 \) and \( W_2 = \pm 2\hbar c E_{\text{m}} \), we convert equations (8.4) and (8.5) into the expressions:

\[
\hbar^2 \psi_{\text{m}}^2 \partial_0^2 \phi_{\text{m}} - \hbar^2 \phi_{\text{m}}^2(\partial_1^2 - \partial_2^2) \partial_0 \phi_{\text{m}} = 2\hbar c E_{\text{m}} \psi_{\text{m}} \psi_{\text{m}}^* \quad \phi_{\text{m}}^* \psi_{\text{m}} = 2\hbar c E_{\text{m}} \psi_{\text{m}}^* \phi_{\text{m}}
\]

(8.18)

For boost transformations at constant speed \( c \), it obese time-invariance:

\[
\dot{\phi}_{\text{force}} = \psi_{\text{m}}^* \frac{-\hbar^2}{2\hbar c} \partial_1 \partial_2 \phi_{\text{m}} + \phi_{\text{m}} \frac{-\hbar^2}{2\hbar c} \partial_1 \partial_2 \phi_{\text{m}}^* \to 0
\]

(8.19)

Adding (8.18) and (8.19) together, we derive a trace of the diagonalized tensors in forms of a wave equation at event \( \lambda = c \):

\[
\frac{1}{c} \partial_0^2 \phi_{\text{m}} + \partial_1^2 \phi_{\text{m}} = \frac{4\hbar c E_{\text{m}}}{2\hbar c} \phi_{\text{m}} : \phi_{\text{m}}^* = \phi_{\text{m}} \phi_{\text{m}}^*
\]

(8.20)

The energy flow, \( 4\hbar c E_{\text{m}} / (\hbar c) \), represents that a pair of the irreducible units \( E_{\text{m}} \) exist between physical-particle \( E_{\text{m}} \) or virtual-wave \( E_{\text{m}} \) states alternatively, but may or may not be at the same states \( E_{\text{m}} \), \( m = \hbar c \), where \( \hbar c \) is known as Planck matter-energy, introduced in 1900 [9]. Consequently, light is consisted of two units: a pair of Photons. For a total of mass-energy \( 4mc^2 \), the above equation presents a conservation of the photon energy-momentum and relativistic invariance.

Artificial 8.8: 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 is consisted of virtual energy duality as its irreducible unit: 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.

Artificial 8.9: 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:

\[
(P + iE) (P - iE) = 4\hbar c E_{\text{m}} E_{\text{m}} = \phi_{\text{m}} \phi_{\text{m}}^* : P = ic \phi_{\text{m}}
\]

(8.22)

known as the relativistic invariance relating a pair of intrinsic masses at their energy \( E \) and momentum \( P \). As a duality of alternating actions \( E \propto \hbar c = mc^2 \), one operation \( P + iE \) is a process for physical reproduction or animation, while another \( P - iE \) is a reciprocal process.

Universal and Unitech Field Theory
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]:

\[ S_i(\omega_i, T) = 4 \left( \frac{\alpha \pi^2}{3 \hbar^2 c^2} \right) n_{\omega} \left( \frac{\omega_i}{c} \right)^2 \rightarrow \frac{4 E^+ E^+}{(hc)^2} : \eta_c = \pi^3 \]  

(8.23)

where the factor 4 is compensated to account for one black body with minimum of two physical \( Y^+ \) and one virtual \( Y^+ \) quarks. The above equivalence results in a pair of the complex formula:

\[ E^+ = \pm \frac{1}{2} \hbar \omega \quad : \eta_c = \pi^3 \approx 33 \% \]  

(8.24)

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

IX. QUANTUM ELECTRO-DYNAMICS.

From (7.8) and (7.11), the \( \psi^0 \bar{\phi}^0 + \psi^1 \bar{\phi}^1 \) tensors are mapped to the electromagnetic fields\( \psi^0 \bar{\phi}^0 + \psi^1 \bar{\phi}^1 \rightarrow F_{\mu \nu} = \bar{\phi}^\mu \partial^\nu - \bar{\phi}^\nu \partial^\mu \) for the invariance of the off-diagonal elements for the “pure” singlet into the field interactions (or equivalently “gauge” invariance) [4] fixing of the vector potential. It might be while, simultaneously, boost \( \gamma^\pm \) tensors generate the hypercharge fields \( F_{\mu \nu} \). Precisely, we extend the "pure" singlet field \( W^\pm_{\mu \nu} \) into (9.1)-(9.2) and map the operation \( \partial_{\mu} \rightarrow c D_{\mu} \) to extend the gauge fields that result in the above equations.

Artifacts 9.5: Standard Model. Given 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 \( \partial_{\mu} \rightarrow c D_{\mu} \) and \( W_{\mu \nu} \rightarrow G_{\mu \nu} \) to represent the Standard Model associated with gauge transformation:

\[ (9.8) \]

\[ D_{\mu} = \partial_{\mu} + i e A_{\mu} \; G_{\mu \nu} \approx A_{\mu} + g f^{\alpha \beta \gamma} A_{\mu}^{\alpha} A_{\nu}^{\beta} A_{\lambda}^{\gamma} \]  

where \( A_{\mu} \) are the gluon fields, \( f^{\alpha \beta \gamma} \) 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:

\[ (9.9) \]

\[ g_i \] is the strong coupling constant, \( G_{\mu \nu} \) is the 8-component SU(3) gauge field, and \( T_\alpha \) are the 3 \( \times \) 3 Gell-Mann matrices [18], introduced in 1962, as generators of the SU(3) color group.

Artifacts 9.6: Field Interactions. Parallel to Dirac matrix (8.9) given by Lorentz Generators (7.4), Spiral Torques \( K_{\alpha \nu} \) (3.5) and (3.7) create the generator \( x_i \) to couple with the gauge field \( B_{\mu} \) in the first horizon U(1):

\[ 2 x_i \delta^{\mu \nu} = i \lambda_i K_{\alpha \nu} \delta^\alpha \partial^\mu - i \pi K_{\mu \nu} \partial^\mu \rightarrow : \partial_\mu \rightarrow c D_\mu \]  

(9.11)

where \( Y_\alpha \) is the hypercharge. Therefore, the weak coupling \( \xi_{CP} \) (9.8) is extendable to and known as classic QCD, discovered in 1973:

\[ \xi_{CP} = - \xi_{CP} (g' + g T_\nu) \psi_{\nu} \rightarrow \xi_{EW} \]  

(9.12)

where gauge field \( W_{\mu} \) is a 3-component of the second horizon SU(2), Pauli matrices \( \sigma_i \) are the infinitesimal generators of SU(2) group for left-chiral fermions, and \( g \) is the SU(2) coupling constants.

Artifacts 9.7: Y' Strong Interactions. Because of Spiral Torques, (8.20) becomes time-dependent and defines the classic Lagrangian that (8.18) and (8.19) can be extended and reformulated into the following:

\[ \xi_{FO} = - \frac{1}{2 E_{\mu \nu} \omega c} \left( \frac{\hbar}{c} \right)^2 \left( \frac{1}{2} \delta^\mu \partial^\nu \psi_\mu^0 4 m^2 \psi_0^0 - \lambda \psi_{\nu \mu} \right) \]  

(9.13)

where \( \psi_0^0 \), \( \psi_\mu^0 \), and \( E_{\mu \nu} \) are applied, and \( \lambda \) is the higher order constance for the potential fields. With the gauge invariance (3.9)-(3.10) and \( \phi \rightarrow (v + \phi + i \phi_3) / \sqrt{2} \), 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 characteristic and distinguishable under each scope of horizons for its mathematical interpretations, respectively:
1. A weak force is among the dynamic interruptions under the $Y^+$ supremacy: $(\phi^+_q, \phi^-_q)$, dominated by the off-diagonal elements of the field tensors.

2. As a natural duality, a strong force is among the dynamic interruptions under the $Y^-$ supremacy: $(\phi^-_q, \phi^+_q)$, dominated by the diagonal elements of the field tensors.

3. Apparently, given rise by the second horizon (3.9)-(3.10) or classically known as Gauge Theory, the interactive forces define the simple symmetry group $U(1) \times SU(2)$ in the Standard Model.

4. Furthermore, an integrity of the strong nuclear forces is characterized at the third horizon of the tangent vector interactions (3.14) and (3.16) 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 $\lambda = 1$, the formula (9.3) in forms of the $Y^+$ vector (7.12) is balanced with resource of the four-vector density currents $\rho_q, \mathbf{J}_q$, or simply in the forms of $\partial_t \mathbf{F}_\mu^\nu = (\rho_q \mathbf{J}_q)$:

$$\partial_t \mathbf{F}_\mu^\nu = -\left(ie \phi^\nu_\mu \mathbf{u} \mathbf{V}\right)\begin{pmatrix} 0 & \mathbf{D}_q^\mu + \mathbf{H}_q^\nu \times \mathbf{H}_q^\nu \\ -\mathbf{D}_q^\mu - \mathbf{H}_q^\nu \times \mathbf{H}_q^\nu & \mathbf{u} \mathbf{u}_q \end{pmatrix} = (\rho_q \mathbf{J}_q)$$

(10.1)

These are equivalent to or given as a set of the field equations:

$$(\mathbf{u} \mathbf{V} \cdot \mathbf{D}_q^\mu = \rho_q, \mathbf{V} \cdot \mathbf{E}_q^\mu = 0)$$

(10.3)

$$(\mathbf{u} \cdot \mathbf{V} - \mathbf{V} \times \mathbf{H}_q^\mu - \mathbf{H}_q^\mu \cdot \mathbf{V} \times \mathbf{H}_q^\mu = -\mathbf{J}_q + \mathbf{H}_q^\mu \cdot \mathbf{V} = \mathbf{u} \mathbf{u}_q \mathbf{c})$$

(10.4)

where the volume $\mathbf{V} = (\mathbf{u} \times \mathbf{H}) = \mathbf{H} \cdot (\mathbf{V} \times \mathbf{u}) - \mathbf{u} \cdot (\mathbf{V} \times \mathbf{H})$, is applied. Therefore, the charged particles under the $Y^+$ supremacy generate Electric Displacing $\mathbf{D}_q^\mu$ and Magnetic Polarizing $\mathbf{H}_q^\mu$ fields, which are balanced by the physical resources $(\rho_q, \mathbf{J}_q)$. Simultaneously at the $Y^-$ supremacy, equation (8.5) contains only one off-diagonal matrix $\partial_t \mathbf{J}_q$. It implies the off-diagonal elements be conserved to zero: $\partial_t (\mathbf{F}_\mu^\nu)_{\alpha} = 0$, and results in the continuity equations of:

$$(\mathbf{u} \mathbf{V} \cdot \mathbf{B}_q^\mu = 0, \mathbf{V} \cdot \mathbf{D}_q = \dot{\rho}_q$$

(10.5)

$$\frac{\partial \mathbf{B}_q^\mu}{\partial t} + \mathbf{V} \times \mathbf{E}_q^\mu = 0$$

(10.6)

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

**Artfact 10.1: Maxwell’s Equations.** At the constant speed $c$, the above equations emerges a set of the classical equations:

$$\mathbf{V} \cdot \mathbf{B}_q = 0$$

(10.7)

$$\mathbf{V} \cdot \mathbf{D}_q = \dot{\rho}_q$$

(10.8)

$$\frac{\partial \mathbf{B}_q}{\partial t} + \mathbf{V} \times \mathbf{E}_q^\mu = 0$$

(10.9)

$$\mathbf{V} \times \mathbf{H}_q^\mu - \frac{\partial \mathbf{D}_q}{\partial t} = -\mathbf{J}_q$$

(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 changes of each other. One important consequence of the equations is that they demonstrate how fluctuating electric and magnetic fields propagate at the speed of light.

**XI. CONCLUSION**

Complying with the 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 $\mathcal{L}$** 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 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, Lorentz Gauge, Yang-Mills actions, and Quantum Chromodynamics, including the week 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 $\partial_t (\mathbf{F}_\mu^\nu)_{\alpha} = 0$ and $\partial_t \mathbf{E}_\mu^\nu = (\rho_q, \mathbf{J}_q)$, rising from the quantum fields.

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

**REFERENCES**


