《Universal and Unified Field Theory》 — 3. Photon, Light and Electromagnetism

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Abstract: For the first time, ***Law of Conservation of Light*** is uncovered that consists of the seven principles including the wave-particle duality as well as the *Photon Entanglements* beyond the speed at constant c. In addition, another ***Law of Fluxion Continuity*** unfolds concisely the classical theory of *Lorentz* force and *Maxwell's* equations. With these applications to the classical physics, *Universal Field Theory* demonstrates and derives, but are not limited to, *Electromagnetism* given rise from the first horizon of *Quantum Mechanics*.

Keywords: Unified field theories and models, Spacetime topology, Field theory, Quantum mechanics, Classical electromagnetism,
PACS: 12.10.-g, 04.20.Gz, 11.10.-z, 03.65.-w, 03.50.De

INTRODUCTION

A duality nature of virtual and physical coexistences is a universal phenomenon of dynamic entanglements, which always performs a pair of the reciprocal entities. Each of the states cannot be separated independently of the others. Only together do they form a system as a whole. The potential entanglements are a fundamental principle of the real-life steaming such that one constituent cannot be fully described without considering the other. As a consequence, the state of a composite system is always expressible as a sum of products of states of each constituents. Under the law of event operations, they are fully describable by the mathematical framework of the dual manifolds.

In this manuscript, the boost transportations are considered restrictedly such that the equations of (3.6) and (3.7) (from reference [1]) are simplified to the following formula, which represents the torsion-free transformations:

$$\hat{\partial}_\lambda \psi = \dot{x}_a J^+_{\mu a} \partial^\mu \psi \qquad : J^+_{\mu a} \equiv \frac{\partial x^\mu}{\partial x_a}, \quad \dot{x}^\mu = \partial x^\mu / \partial\lambda, x^\mu \in Y\{\hat{x}\}$$

$$\check{\partial}^\lambda \psi = \dot{x}^\alpha J^-_{m\alpha} \partial_m \psi \qquad : J^-_{m\alpha} = \frac{\partial x_m}{\partial x^\alpha}, \quad \dot{x}_m = \partial x_m / \partial\lambda, x_m \in Y\{\check{x}\}$$

As the function quantity of an object, a scalar field forms and projects its potentials to its surrounding space, arisen by or acting on its opponent through a duality of reciprocal interactions dominated by *Lorentz Generators*.

Because of the scaler transport through the boost entanglements, the boost communicates give rise to the first and second horizons of vector fields and tensor fields aligning with the stationary or inertial curvatures.

X. HORIZON OF DYNAMIC FIELDS

In the global environment, the Y^-Y^+ dark energies have their commutations at operational uniformity to maintain a duality of their equal primacy. Assume the events are exerted homogeneously $\lambda_i \mapsto \lambda$ at the indistinct time $\lambda_t \mapsto t$ instantaneously and simultaneously. From the density equations, the physical events simultaneously operate another dual state $\{\phi_n^+, \varphi_n^-\}$ and their movements, $\dot{\partial}_\lambda \left(\varphi_n^+ \phi_n^-\right)$, that give rise to the Y^+ fluxions of equation and are associated with its density ρ_n^+ and its current $\mathbf{j}_\mathbf{n}^+$. Given by the equations of (8.7) paired with (8.13) (from reference [2]):

$$\varphi_n^- \left(\kappa_1 + \kappa_2 \hat{\partial}_{\lambda_3}\right)\left(\check{\partial}^{\lambda_2} - \hat{\partial}_{\lambda_2}\right)\phi_n^+ + \kappa_2 \varphi_n^- \hat{\partial}_{\lambda_3} \hat{\partial}_{\lambda_2} \phi_n^+ = \varphi_n^- W_n^+ \phi_n^+ \tag{10.1}$$

$$\phi_n^+ \left(\kappa_1 + \kappa_2 \hat{\partial}_{\lambda_3}\right)\left(\hat{\partial}_{\lambda_2} - \check{\partial}^{\lambda_2}\right)\varphi_n^- + \kappa_2 \phi_n^+ \check{\partial}^{\lambda_3} \check{\partial}^{\lambda_2} \varphi_n^- = \phi_n^+ W_n^- \varphi_n^- \tag{10.2}$$

the successive operations entangle the scalar potentials in fluxions streaming a set of the Y^+ Quantum Fields into another pair of the Y^-Y^+ motion dynamics: one symmetry $\dot{\partial}_\lambda \mathbf{f}_s^+$ continuity and another asymmetric $\dot{\partial}_\lambda \mathbf{f}_a^+$ motion dynamics, respectively.

Add the above two equations, we have the Y^+ fluxion of density continuity $\dot{\partial}_\lambda \mathbf{f}_s^+ = \kappa_2 \left[\hat{\partial}_\lambda \hat{\partial}_\lambda, \check{\partial}^\lambda \check{\partial}^\lambda\right]^+$ as the symmetric formulation:

$$\dot{\partial}_\lambda \mathbf{f}_s^+ = \left[W_0\right]^+ - \left\langle \left(\kappa_1 + \kappa_2 \check{\partial}_\lambda\right)\left(\check{\partial}^\lambda - \hat{\partial}_\lambda\right) \right\rangle^+ + \kappa_2 \zeta^+ \tag{10.3}$$

$$\kappa_1 = -i\frac{\hbar c^2}{2}, \qquad \kappa_2 = \frac{(\hbar c)^2}{2\tilde{E}_c^+}, \qquad \kappa_g^+ = \frac{-1}{\hbar c} \tag{10.4}$$

$$\zeta^+ = \left\langle \left(\hat{\partial}_{\lambda_3} - \check{\partial}_{\lambda_3}\right)\left(\hat{\partial}_{\lambda_2} - \check{\partial}^{\lambda_2}\right) \right\rangle^+ \mapsto 0 \tag{10.5}$$

The entangle bracket $\left[\hat{\partial}_\lambda \hat{\partial}_\lambda, \check{\partial}^\lambda \check{\partial}^\lambda\right]^+$ of the Y^+ general dynamics features the Y^+ ***Transforming Continuity***. 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. Under the symmetric balance $\zeta^+ \mapsto 0$, it maps the movement $\hat{\partial}_{\lambda_3}$ to or approximated as $\check{\partial}_{\lambda_3}$ towards the Y^+ supremacy of flux continuity, known as the Y^+ continuity equation $\dot{\partial}_\lambda \mathbf{f}_s^+ = K_s^+$.

In a parallel fashion, there is another dual state fields $\{\phi_n^-, \varphi_n^+\}$ in the dynamic equilibrium, given by the equations of (8.12) paired with (8.8) (from reference [2]):

$$\varphi_n^+ \left(\kappa_1 + \kappa_2 \hat{\partial}^{\lambda_2}\right)\left(\hat{\partial}^{\lambda_1} - \check{\partial}_{\lambda_1}\right)\phi_n^- + \kappa_2 \varphi_n^+ \check{\partial}_{\lambda_2} \check{\partial}_{\lambda_1} \phi_n^- = \varphi_n^+ W_n^- \phi_n^- \tag{10.6}$$

$$\phi_n^- \left(\kappa_1 + \kappa_2 \check{\partial}^{\lambda_2}\right)\left(\check{\partial}_{\lambda_1} - \hat{\partial}^{\lambda_1}\right)\varphi_n^+ + \kappa_2 \phi_n^- \hat{\partial}^{\lambda_2} \hat{\partial}^{\lambda_1} \varphi_n^+ = \phi_n^- W_n^+ \varphi_n^+ \tag{10.7}$$

Add the equations, we have the Y^- fluxion of symmetric density continuity $\dot{\partial}_\lambda \mathbf{f}_s^- = \kappa_2 \left[\check{\partial}_\lambda \check{\partial}_\lambda, \hat{\partial}^\lambda \hat{\partial}^\lambda\right]^-$ of motion dynamics:

$$\dot{\partial}_\lambda \mathbf{f}_s^- = \left[W_0\right]^- - \left\langle \left(\kappa_1 + \kappa_2 \check{\partial}^\lambda\right)\left(\hat{\partial}^\lambda - \check{\partial}_\lambda\right) \right\rangle^- + \kappa_2 \zeta^- \tag{10.8}$$

$$\zeta^- = \left\langle \left(\check{\partial}^{\lambda_2} - \hat{\partial}^{\lambda_2}\right)\left(\check{\partial}_{\lambda_1} - \hat{\partial}^{\lambda_1}\right) \right\rangle^- \mapsto 0 \quad : \left[W_0\right]^- = c^2 \tilde{E}_c^+ \tag{10.9}$$

The entangle bracket $\left[\check{\partial}_\lambda \check{\partial}_\lambda, \hat{\partial}^\lambda \hat{\partial}^\lambda\right]^-$ of the Y^- general dynamics features the Y^- ***Mirroring Continuity***. 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 an intrusive effects to the virtual world. In other words, the virtual world is aware of and immune to the physical world. Under the symmetric balance $\zeta^- \mapsto 0$, it maps the movement $\hat{\partial}^{\lambda_2}$ to or approximated as $\check{\partial}^{\lambda_2}$ towards the Y^- supremacy of flux continuity, known as the Y^- continuity equation $\dot{\partial}_\lambda \mathbf{f}_s^- = K_s^-$.

Generally, the $\zeta^\pm \neq 0$ represents the Y^+ or Y^- asymmetric conservation. As a precise duality, it coexists with symmetric continuity to extend discrete subgroups, and exhibits additional dynamics to operate world-line motions and carry on the symmetric system. Throughout the rest of this paper, fluxions satisfy the conditions of Y^-Y^+ *Symmetry Entanglements*, $\zeta^\pm = 0$, known as a system without asymmetric entanglements that does not have additional flex transportation asynchronously.

XI. LAW OF CONSERVATION OF LIGHT

Because of virtual resources are massless, the flux continuity conserved to the Y^- resources is at zero 0^+. At the stationary or inertial condition $\left[W_0\right]^- = c^2 \tilde{E}_c^+$ of the initial energy $\tilde{E}_c^+$, the boost environment has the continuity equations or acceleration tensors:

$$\mathbf{g}_d^- = \frac{\hbar c}{\tilde{E}_c^-}\dot{x}_\kappa \partial_\kappa \eta_m - \frac{c^2 \tilde{E}_c^+}{\hbar c} + ic\left\langle \dot{x}_\kappa \partial_\kappa \right\rangle_d^- \quad : \dot{x}_\kappa \partial_\kappa = \left(ic\frac{\partial}{\partial x_0} \quad \mathbf{u}\nabla \right) \quad (11.1)$$

where $\langle\ \rangle_d^-$ is for the trace of diagonal elements, $\eta_m = \partial^m \Phi_c^-$ is given by the equation (5.9) [1], and Φ_c^- is the *Potential Density of Light*. It is intrinsic that these elements of the acceleration tensor $\mathbf{g}_d^-$ are entangling and transforming between physical and virtual manifolds. For fluxion dynamics, it leads to divergence conservation or free under the physically three-dimensional coordinates and the two-dimensional world plane $\{\mathbf{r} \pm i\mathbf{k}\}$ extending into the tetrad coordinates, respectively.

As the trace of diagonal elements of the continuity equation, the pure time entanglement $\left\langle \dot{x}_\kappa \partial_\kappa \right\rangle^-$ is undetectable or equivalent to zero, which is know as a time translation symmetry. For the motion speed at $\mathbf{u}$, the acceleration tensor $\mathbf{g}_d^-$ of equation (11.1) can be expressed as the regular vector and matrix form:

$$\mathbf{g}_d^- = \frac{\hbar c}{\tilde{E}_c^-}\left(ic\frac{\partial}{\partial x_0} \quad \mathbf{u}\nabla \right)\begin{pmatrix} -ic\frac{\partial}{\partial x^0} \\ \mathbf{u}\nabla \end{pmatrix}\Phi_c^- - \frac{c^2 \tilde{E}_c^+}{\hbar c} \quad (11.2)$$

Considering the wave function at a constant speed $\mathbf{u} \mapsto c$, the above acceleration tensor $\mathbf{g}_d^-$ represents that the potential density Φ_c^- of light is transporting as waves, conserving to a constant, and maintaining its states of a system as the following:

$$\frac{1}{c^2}\frac{\partial^2 \Phi_c^-}{\partial t^2} + \nabla^2 \Phi_c^- - \left(\frac{E_c}{\hbar c}\right)^2 = 0^+ \qquad : E_c^2 = \tilde{E}_c^- \tilde{E}_c^+ \quad (11.3)$$

introduced at 20:00 August 19, 2017 *Metropolitan Washington, DC*. The above equation states that, when light is a constant at speed c, it has the following characteristics:

1) Light remains constant and conserves over time during its transportation.
2) Light is consisted of virtual energy with $\hbar c$ as its irreducible photon unit.
3) Light has at least two photons for entanglement at zero net momentum
4) Light transports and performs a duality of virtual waves and real objects.
5) Neither can a light energy of potential density be created nor destroyed.
6) Light transforms from one form to another carrying quantum messages.
7) Without an energy supply, no light can be delivered to its surroundings.

Therefore, the above equation is named as the ***Law of Conservation of Light***. This conservation law is rigorously derived by a direct consequence of Y^- fluxion continuity balanced at Y^+ time translation symmetry.

Artifacts 17: Photon. Since light exhibits wave–particle duality, its properties must acquire characteristics of both waves and particles. A duality of the energy formations of light has both of its convertible form to physical mc^2 and its transportable form at virtual $\hbar\omega$. It is conservation of energy $\mathbf{P} \pm i\tilde{E}^\pm = m_c c^2$ and invariance of momentum $\mathbf{P} = ic\hat{\mathbf{p}} \mapsto \mp i\hbar c\mathbf{k}$ that maintain the light transformable between virtual and physical states. Together, it derives a pair of irreducible virtual unit $\pm\hbar\omega$, known as *Planck–Einstein* relation as well as a physical unit mc^2. From equation (11.3), the property of light becomes a complex form of virtual and physical duality as the following:

$$\tilde{E}_c^\mp = \hbar\omega \pm imc^2 \qquad : \hbar\omega \rightleftharpoons mc^2 \quad (11.4)$$

known as ***Photon Energy*** - a fundamental property of light. As a constant, the energy defines an irreducible virtual unit, $\hbar\omega$, named as *Photon* at its virtual state. The photon's wave and quanta qualities are two observable aspects of a single phenomenon, which obey law of conservation of energy as the following:

$$\tilde{E}_c^- \tilde{E}_c^+ = m_c^2 c^4 + \hbar^2\omega^2 \qquad : \mathbf{p}c = \hbar\mathbf{k}c \mapsto \hbar\omega \quad (11.5)$$

where $\mathbf{p}$ is the momentum vector. In the center of entanglement, the colliding duality has no net momentum. Whereas a single photon always has momentum, conservation of momentum (equivalently, transformation invariance) requires that at least two photons are created for entanglement, with zero net momentum.

XII. ELECTROMAGNETISM

As the off-diagonal elements, the fluxion generates acceleration tensor $\mathbf{g}_\times^+$ under virtual primacy for physical forces, and $\mathbf{g}_\times^-$ under physical primacy for virtual forces 0^+. For a micro or macro system, both acceleration tensors represent the time divergence of the Y^+ or Y^- dark fluxions acting on a physical object. With the substitution of equation (5.9) and (5.11) [1], the formulae of (10.8) and (10.3) are translatable at approximately to the first order:

$$\mathbf{g}_x^- = \frac{\hbar c}{\tilde{E}_c^-}\dot{x}_\kappa \partial_\kappa \left\langle F_{m\alpha} \right\rangle_\times^- = \mathbf{K}_s^+ \qquad : \mathbf{K}_s^+ \mapsto 0^+ \quad (12.1)$$

$$\mathbf{g}_\times^+ = i\frac{c}{2}\left\langle \hat{\partial}_\lambda - \check{\partial}^\lambda \right\rangle_\times^+ = ic\left\langle F_{\mu a} \right\rangle_\times^+ = \mathbf{K}_s^- \qquad : \frac{\hbar c}{2\tilde{E}_c^+}\check{\partial}_\lambda \ll i\frac{c}{2} \quad (12.2)$$

where the symbol $\langle\ \rangle_\times^\mp$ indicates the off-diagonal elements of a tensor. Although the initial virtual environment, is generally massless, the Y^+ flux continuity is balanced to its physical resources $\mathbf{K}_s^- \neq 0$.

Artifacts 18: Faraday's and Gauss's Laws. For the off-diagonal elements $\mathbf{g}_\times^-$ of the Y^- acceleration tensor $\mathbf{g}^-$, the dark fluxion equation of Y^- boost fields has the conservation equation: $\check{\partial}_\lambda \mathbf{f}^- = 0$, sourced by the virtual time operation $\lambda = t$. Given by the Y^- *Transform Tensor* $\left\langle F_{m\alpha} \right\rangle^-$ of the equation (5.9) (reference [1]), the conservation equation (12.1) forms up an acceleration tensor for the electromagnetic fields:

$$\mathbf{g}_x^- = \left(ic\frac{\partial}{\partial x_0} \quad \mathbf{u}\cdot\nabla \right)\begin{pmatrix} 0 & c\mathbf{B}_c^- \\ -c\mathbf{B}_c^- & \mathbf{b}\times\mathbf{E}_c^- \end{pmatrix}_\times + 0^+ \quad (12.3)$$

where $\mathbf{b}_m$ is the coordinate basis of the Y^- manifold. The field $\mathbf{E}_c^-$ is *Electric Field* and $\mathbf{B}_c^-$ is *Magnetic Field*, which are derived by the Y^- *Transform Tensor* as the following:

$$\mathbf{B}_c^- = \hbar \sum_n \frac{p_n^-}{\tilde{E}_n^-}\beta_\alpha \qquad : \alpha \in \{1,2,3\} \quad (12,4)$$

$$\mathbf{b}\times\mathbf{E}_c^- = \hbar c \sum_n \frac{p_n^-}{\tilde{E}_n^-}\varepsilon_{iam}^- e_i \qquad : i \neq a \neq m \in \{1,2,3\} \quad (12.5)$$

Therefore, the acceleration tensor $\mathbf{g}_\times^-$ for the off-diagonal components is equivalent to a pair of the well-known equations:

$$(\mathbf{u}\nabla)\cdot\mathbf{B}_c^- = 0 \quad (12.6)$$

$$\frac{\partial \mathbf{B}_c^-}{\partial t} + \left(\frac{\mathbf{u}}{c}\cdot\nabla\right)\times\mathbf{E}_c^- = 0 \quad (12.7)$$

The first equation is known as *Gauss's Law* [3] for magnetism. The second is *Michael Farads's Law* for induction, discovered in 1831 [4]. Traditionally, they are the basic laws of electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force. This phenomenon, called electromagnetic induction, is the fundamental operating principle of transformers, inductors, and many types of electrical motors, generators and solenoids.

Following the Y^-Y^+ principle, the magnetic field in space is subject to time virtually associated with its physical opponent of the electric field such that, together, they serves as commutation resources, entangling in the dual manifold spaces in form of massless waves and in messaging or transporting events at light speed.

Artifacts 19: Lorentz Force. For an integrity of microscopic effects at the third horizon, a time derivative to the fluxion fields formulates an acceleration tensor to give rise to the vector field from the equations of (5.11) (from reference [1]).

$$\mathbf{g}_\times^+ = ic\left\langle F_{\mu a} \right\rangle_\times^+ = ic\begin{pmatrix} 0 & c^2\mathbf{D}_c^+ \\ -c^2\mathbf{D}_c^+ & \mathbf{u}\times\mathbf{H}_c^+ \end{pmatrix}_\times \quad (12.8)$$

$$\mathbf{D}_c^+ = \frac{1}{c^2}\sum_n p_n^+ d^a \qquad : a \in (1,2,3) \tag{12.9}$$

$$\mathbf{u} \times \mathbf{H}_c = \sum_n p_n^+ \varepsilon_{\nu\alpha\mu}^+ h^\nu \quad : \nu \neq a \neq \mu \in (1,2,3) \tag{12.10}$$

where $\mathbf{D}_c^+$ and $\mathbf{H}_c^+$ are named as *Electric Displacing* and *Magnetic Polarizing* fields. For a point charge moving with velocity $\mathbf{u}$, the acceleration field of equation (12.2) represents the electromagnetic force:

$$\mathbf{F}_q^+ = \kappa_q^+ \mathbf{g}_\times^+ = Q\mu_e \left(c^2 \mathbf{D}_c^+ + \mathbf{u} \times \mathbf{H}_c^+\right) \tag{12.11}$$

$$\kappa_q^+ = -\frac{i}{c} Q\mu_e, \qquad c^2 = \frac{1}{\varepsilon_e \mu_e} \tag{12.12}$$

where Q is charge of a system, ε_e is the permittivity and μ_e the electromagnetic permeability of the materials. Without displacement and polarization, the constitutive relations results in the summation of the electric and magnetic forces in the free space:

$$\mathbf{F}_q^+ = Q\left(\mathbf{E}_c^- + \mathbf{u} \times \mathbf{B}_c^-\right) \quad : \mathbf{D}_c^+ = \varepsilon_e \mathbf{E}_c^-, \ \mathbf{B}_c^- = \mu_e \mathbf{H}_c^+ \tag{12.13}$$

known as *Lorentz Force*, discovered in 1889 [5]. This Lorentz Force was first formulated by James Clark Maxwell in 1865 [6], then by Oliver Heaviside in 1889 [7], and finally by Hendrick Lorentz in 1891 [8].

Traditionally, the Lorentz law describes the electromagnetic interactions by the force acting on a moving point charge in the presence of electromagnetic fields. A particle of charge Q moving with velocity $\mathbf{u}$ in its induction of an electric field $\mathbf{E}_c^-$ and a magnetic field $\mathbf{B}_c^-$ experiences a force $\mathbf{F}_q^+$. A positively charged particle will be accelerated in the same linear orientation as the $\mathbf{E}_c^-$ field, but will curve perpendicularly to both the instantaneous velocity vector $\mathbf{u}$ and the $\mathbf{B}_c^-$ field according to the right-hand rule.

Artifacts 20: Ampère's Circuital Law. Entangling with the Y^+ fluxion $\dot{\partial}_\lambda \mathbf{f}_n^+$, the reaction of the Y^- force is formulated by the electric and magnetic fields. Meanwhile, the Y^+ fluxion continue to operate through the time events $\dot{\partial}_\lambda$ on the electromagnetic acceleration fields, which evolve and give rise to the next field entanglements:

$$\dot{\partial}_\lambda \mathbf{g}_\times^+ = ic\left(ic\frac{\partial}{\partial x_0} \quad \mathbf{u}\cdot\nabla\right)\begin{pmatrix} 0 & c^2\mathbf{D}_c^+ \\ -c^2\mathbf{D}_c^+ & \mathbf{u}\times\mathbf{H}_c^+ \end{pmatrix}_\times \tag{12.14}$$

$$\dot{\partial}_\lambda = \left(ic\frac{\partial}{\partial x_0} \quad \mathbf{u}\nabla\right), \lambda = t \tag{12.15}$$

For the macro density and current, the contravariant vector combines or entangles with the electric charge density ρ_q and electric current density $\mathbf{J}_q$ that can be balanced by the physical resources and defined by the following four-vector as the continuity equation:

$$\dot{\partial}_\lambda \mathbf{g}_\times^+ = \mathbf{K}_s^- \qquad : \mathbf{K}_s^- \in -ic^3\{\mathbf{u}\rho_q, \mathbf{J}_q\} \tag{12.16}$$

Therefore, the above combination derives the general equations of the electric displacing field $\mathbf{D}_c^+$ and magnetic polarizing $\mathbf{H}_c^+$ field as the following:

$$\nabla \cdot \mathbf{D}_c^+ = \rho_q \tag{12.17}$$

$$\frac{\mathbf{u}\cdot\mathbf{u}}{c^2}\nabla\times\mathbf{H}_c^+ - \frac{\partial \mathbf{D}_c^+}{\partial t} = \mathbf{J}_q + \mathbf{H}_c^+\cdot\left(\frac{\mathbf{u}}{c}\nabla\right)\times\frac{\mathbf{u}}{c} \tag{12.18}$$

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. For the speed at a constant, the above equation is simplified to and known as *Ampère's Circuital Law*, discovered in 1823 [4]. Traditionally, Ampère's law with Maxwell's addition describes how the magnetic field "circulates" around electric currents and time varying electric fields. It states that for any closed loop path, the sum of the length elements times the magnetic field in the direction of the length element is equal to the permeability times the electric current enclosed in the loop. The magnetic field in space around an electric current is proportional to the electric current which serves as its source, similar to the electric field in space is proportional to the charge which serves as its source.

Artifacts 21: Maxwell's Equations. At the speed $\mathbf{u}$ equivalent to a constant, a set of the four equations of (12.9), (12.10), (12.17) and (12.18) are further simplified to a collection of the electromagnetic equations as the following:

$$\nabla\cdot\mathbf{B}_c^- = 0^+ \qquad : \text{Conservation of } Y^- \text{ Fluxions} \tag{12.19}$$

$$\nabla\cdot\mathbf{D}_c^+ = \rho_q \qquad : \text{Conservation of } Y^+ \text{ Fluxions} \tag{12.20}$$

$$\frac{\partial \mathbf{B}_c^-}{\partial t} + \nabla\times\mathbf{E}_c^- = 0^+ \qquad : Y^- \text{ Continuity Equation} \tag{12.21}$$

$$\frac{\partial \mathbf{D}_c^+}{\partial t} - \nabla\times\mathbf{H}_c^+ = -\mathbf{J}_q \qquad : Y^+ \text{ Continuity Equation} \tag{12.22}$$

known as Maxwell's Equations that James Clerk Maxwell derived it using hydrodynamics in his 1861 paper "On Physical Lines of Force" derived in 1884 [6].

The Maxwell formulae illustrate that the charge density ρ_q and current $\mathbf{J}_q$ are the physical sources to the electromagnetic fields. Maxwell's equations are a set of partial differential equations that, together with the Lorentz force law, form the foundation of classical electromagnetism, classical optics, and electric circuits. Although the equations describe how electric and magnetic fields are related to each other, one important consequence of the equations is that they demonstrate how fluctuating electric and magnetic fields propagate and entangle at the speed of light. Known as electromagnetic radiation, these waves may occur at various wavelengths to produce spectrum from radio waves.

CONCLUSION

From *First Universal Field Equations* of (8.7), (8.8), (8.12) and (8.13) of reference [2], the Y^-Y^+ fluxions are operated to give rise to the horizons where a set of density continuities is instituted symmetrically to function as electromagnetic fields or the well-known formulae of *Lorentz Force* and *Maxwell's Equations*.

More remarkably, it demonstrates, that, besides the constant speed at c, light is conserved during its photon entanglements:

$$\frac{1}{c^2}\frac{\partial^2 \Phi_c^-}{\partial t^2} + \nabla^2\Phi_c^- = \left(\frac{\tilde{E}_c}{\hbar c}\right)^2 \qquad E_c \propto \hbar\omega \rightleftharpoons mc^2$$

Defined as the ***Law of Conservation of Light***, it states that, in any given frame of reference, the effective potential density of light remains constant and conserves over time during its transportation. The potential density can neither be created nor destroyed; rather, it transforms from one form to another between the virtual wave and physical mass objects by the photon energies of $\tilde{E}_c^\mp = \hbar\omega \pm imc^2$. Besides their physical interruptions of electromagnetism obey the Lorentz Force, whenever the resource is distinguishable by the characteristics of charge distributions.

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