Chapter 5
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Ether of the Maxwell's Wave Equation is the Unified Field for Physics

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ABSTRACT

The key purpose of this chapter is to provide extensive examples and rationale to overcome the currently prevailing resistance to accept the physical reality of Cosmic Ether. We identify this integrative power of Ether, first, by re-defining nature's action generating parameters of this energetic tension field as the electric-tension, ε_0^{-1}, and the magnetic-resistance, μ_0, while re-deriving the Maxwell's wave equation in analogy with the mechanically stretched string, where $c_0^2 = \varepsilon_0^{-1} / \mu_0$ is the perpetually moving velocity of light in the free space. Then, the replacement of c_0^2 by $(\varepsilon_0^{-1} / \mu_0)$ and the rest mass m_0 by using Einstein's $m_0 = E / c_0^2 \equiv E(\mu_0 / \varepsilon_0^{-1})$, one can find that almost all working physics theories are being energized by ε_0^{-1} and μ_0. To complete the unification, we must assume that the elementary particles are also perpetually moving electromagnetic waves (EM waves) of the same Ether. However, they remain spatially localised and stationary as close-looped, in-phase (CLIP) EM wave modes, obeying the laws of Newton. Only the presence of spatial potential gradients (forces) of the surrounding Ether can move them out of their inertia. CLIP particles' harmonic phase driven interactions between quantum particles strengthens the successes of the Schrödinger's equation. The distracting postulates of "plane waves", and the "Pilot Waves" becomes unnecessary to assist their movements. The cosmic universality of Maxwellian wave velocity, and particles as CLIP modes, jointly accommodate the two key postulates of special relativity without the need for unphysical four-dimensionality. The observable universe is manifest only as diverse oscillatory excited states of the Ether. The stable and stationary Cosmic Ether holds 100% of the cosmic energy all the time.

Keywords: Cosmic ether; ether as the unifying field; ether energetic tension field; (1/ ε₀)-electric tension of ether; μ₀-magnetic resistance of ether; particles as localized EM oscillating modes of ether.

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1. INTRODUCTION

1.1 Preamble

The classical physic uses discrete values for the positions of objects and define parameters like the velocity, impulse, force etc. Obviously the geometry of a real object has finite dimensions and is not a mathematical point. The field theory defines that the impact on a object is defined by his surrounding field [1,2]. Since ancient times Ether has been recognized as the physical medium for the transportation of light all across the cosmic space [3-5]. In an earlier paper [6], we have presented the rationale that this Ether is a physically real, energetic tension field, holding 100% of the energy of the universe. The ether tension field has already been used as the unified field for physics, but the reality of the ether has remained hidden under our ingrained habits of mathematical representation, which is the main message of this book chapter. Ether allows for the emergence and continuous propagation of EM waves at all possible frequencies, as shown by the Maxwell wave equation. Schrödinger's "wave" equation has successfully modeled particles as harmonic oscillators through his complex representation. For conceptual unification, we are postulating that all stable elementary particles are also perpetually propagating EM waves, except that their spatial confinement, locality and stability, arise out of their propagation mode property as closed-lopped in-phase (CLIP) propagation. This localized CLIP modes give rise to their built-in inertia to motion, obeying the laws of Newtonian dynamics. We suggest that we should re-name the old ether as Cosmic Ether, to incorporate this new property of allowing the emergence and also sustaining the elementary particles as oscillations of its tension field. Particle-particle and particle-EM wave interactions obey the Superposition Principle (SP) because their mutual stimulations are dictated by the mutual phases of their intrinsic harmonic oscillations. The emergence of SP is not because the particles are “plane waves”. Plane waves do not exist in nature as they violate the conservation of energy. Accordingly, we also do not need any de Broglie’s “Pilot Waves” to guide the motion of the localized particles. Inertial particles are always constrained to move only with the help of some physical potential gradients of the Ether, which Schrodinger had included into the traditional Hamiltonian as $"V"$. *The key purpose of this paper is to provide extensive examples and rationale to overcome the currently prevailing resistance to accept the physical reality of Cosmic Ether.*

1.2 The Methodology of Physics-thinking that Guides the Paper

We believe that the key tool is to think like a system engineer – visualize the invisible *physical interaction processes* that nature is utilizing to maintain the ongoing perpetual and causally-ordered evolution in the universe. Evidence based science (EBS), or experimentally validated theory, has been stagnant for some time [7-11], because of our excessive reliance on the elegance of mathematical theories and also rationalization of the observations using diverse, flexible logics, sometimes self-contradictory.

Let us mention the thinking of some major contributors in physics that we would try to emulate. Newton, as a *hands-on engineer* and as a brilliantly creative mathematician, underscored the necessity of a physical medium intervening the Sun and all the planets to establish the gravitational potential gradient (later, Einstein's "Curvature of Space"), which keeps holding the planets. Newton's contemporary, Huygens, gave the description of the *physical processes* behind the perpetual diffractive propagation of light waves as due to the persistent generation of secondary spherical wavelets out of every points on the wave front [12] in an energetic tension medium, the Ether. Huygens' postulate was formalized into a Huygens-Fresnel diffraction integral (HF-DI) by Fresnel [13], which has been guiding the sustained and continued growth of the fields of optical science and engineering, ever since. The strength and the validity of this HF-DI, basically a superposition integral, was further strengthened by Maxwell's wave equations, which accepts, as its solutions, linear summation of all harmonics waves. Planck triggered the concept of quantumness in this classical world by mathematically showing that the measured Blackbody radiation curve can be matched analytically only if the surface molecules inside the blackbody cavity emit and absorb light as individual quantum cupful of energy $h\nu$. However, Planck gave us another very valuable lesson. We need to identify the *primary physical parameter* that plays the key operational role in the engineering process that trigger any particular phenomenon and generate the measurable physical transformation. We should avoid using any secondary parameter as the key guiding parameter to establish the final interpretation of the phenomenon. The author is making this paraphrase from Planck's book [14] where Planck underscored that he succeeded in deriving his desired expression only after he switched to using the frequency ν, instead of using wavelength λ, where $\lambda = c/\nu$. Twenty five years later, QM formalism proved him right. The primary action parameter for atomic and molecular energy exchange is driven by the dipolar interaction *frequencies* of the involved radiations, not the associated wavelength. The wavelength varies from medium to medium, but not the frequency. Accordingly, we should stay focused on the parameters that are primary action drivers in nature. We will find that the primary action parameters for the Ether are ε_0^{-1} & μ_0 and not ε_0 & μ_0, as was originally presented in the Maxwell's wave equation.

1.3 Flow of the Paper

All perpetual wave propagation requires a parent tension field, like the air-pressure-tension field for sound waves, the surface tension and the gravitational tension for the water waves. Maxwell's wave equation and his differential calculus based derivation of the velocity of light, $c_0^2 = (1/\varepsilon_0\mu_0)$, does not identify what represents the built-in tension of the ether field and what provides the reactional resistance against the generation of the electric tension parameter. In Section 2, we re-derive EM wave equation using Newton's first two laws, the inertia of rest and the inertia of motion, to identify that ε_0^{-1} & μ_0 physically

represent the electric tension and the magnetic resistance, respectively, to generate the perpetually moving EM waves in ether.

In section 3, we use the physics of light propagation to analyze why Michelson's null experiment, which failed to validate either the Ether-drag, or the very existence of Ether. We then use the experience of Michelson to develop and propose a one-way light pulse propagation experiment that can directly validate the existence of Ether. We should note here that, in nature, the velocity of light is altered in the presence of materials (assembly of dipoles), since the effective Ether tension is modified, usually reduced, and the velocity of light is always lower in material media. We have been explaining this as the refractive index n of a material medium, and $c_n = c_0 / n = (1/\varepsilon\mu)^{1/2}$, where ε & μ are the modified tension values of the local Ether tension field within a block of material. The rapidly emerging field of Metamaterials is the engineering art of modifying the tension properties of local Ether within a block of material using the desired combination of material dipoles, modeled by Maxwell's equations.

Section 4 details the core of this paper. It explores the unifying roles of ε_0^{-1} & μ_0 throughout major physics theories. We have proposed that the elementary particles arise as perpetually propagating EM waves, moving in closed-loop, in-phase (CLIP) mode of the Ether, as already mentioned in the *Preamble*. We discuss how the CLIP mode of the Ether accommodates most of the quantum mechanical behaviors of particles and atoms and resolves hand-waiving "wave-particle duality", or the "Pilot-wave", while providing a physical structure to the localized perpetual wave motion like a closed-looped laser mode. We have also discussed that the measurable superposition effect must be a causal and local phenomenon since they are always registered by a finite size detector. We cite examples to justify the emergence of gravity out of electromagnetism. Our cosmic ether model naturally accommodates the two key postulates of the special theory of relativity without the need for a four dimensional universe, which has always been a challenge to the human common sense.

The section 5, connects the necessity of engineering thinking for doing physics, while assuring our sustainable evolution. Section 6 presents the conclusion.

2. EXCAVATING THE OPERATIONAL MEANING FOR ε_0 & μ_0 HIDDEN BEHIND THE PERPETUAL VELOCITY OF LIGHT

2.1 Integrating Concepts from Newton, Maxwell and Einstein to Define the Cosmic Ether

Maxwell derived his wave equation by first reconstructing the integral forms of the already existing empirical laws from the integral calculus forms to the differential calculus forms out of (i) the Ampere's law, (ii) the Faraday's law, (iii) the Coulomb's law, and (iv) the absence of magnetic monopole. His derivation

gave the velocity of light as $c_0^2 = 1/\varepsilon_0\mu_0$. These parameters ε_0 & μ_0 were already defined by his predecessors as electric permittivity and magnetic permeability of the *free space*, respectively. These descriptions do not clarify the operational origin, or the engineering levers used by nature to generate the observed *perpetual velocity of EM waves* in the "free space". Inspection of the wave equation for an ideal classical mechanical tension field, like that for a long stretched string, does imply the emergence of a perpetually propagating wave, once the string is externally perturbed, provided there are no energy dissipating mechanism associated with the string. Accordingly, we will derive the EM wave equation emulating the procedure used for a mechanically stretched string. In other words, we will unite Newtonian particle mechanics (2nd law) with Maxwellian wave mechanics. We also justify the emergence of Newtonian inertia of "mass" out of the electromagnetic properties of the free space, or Ether, using Einstein's mass-energy equivalence relation:

$$m_0 = \mathrm{E}_0 / c_0^2 = \mathrm{E}_0\varepsilon_0\mu_0 \tag{1}$$

The first part of this equation is very well validated in the fields of chemistry and physics. The second part is an identity relation from Maxwell's wave equation. Accordingly, we feel confident that ε_0 & μ_0, associated with a lump of energy E_0 must play critical roles in the emergence of inertia of a material particle of mass m_0.

2.2 Deriving EM wave Equation with Mechanical Analogy to Define Operational Meaning for ε_0 & μ_0

We are now re-defining ε_0^{-1} as the "electric tension" in analogy with the mechanical tension "T" on a stretched string and μ_0 as "magnetic resistance" in analogy with the "inertia (or mass) per unit length" σ [15] (the choice will be apparent later). Our objective is to derive $c_0^2 = \varepsilon_0^{-1} / \mu_0$, just like for mechanical string, $\mathrm{v}^2 = T/\sigma$, mechanical tension divided by the inertia of mass per unit length. Let us consider a one-dimensional segment of the 3D ether where a moving electric dipole has just triggered the emergence of electric fields E_1 & E_2 at the spatial locations x_1 & x_2 due to the local live electric tension ε_0^{-1}. Let us chose a small elemental spatial segment Δx of the electric tension field ε_0^{-1} in Fig. 1 triggered by a dipole with the emergent electric fields E_1 and E_2 at locations x_1 & x_2. Then the component of the unbalanced force in the vertical direction

would be $\varepsilon_0^{-1}(\sin\theta_2 - \sin\theta_1)$. The angles being very small, $\sin\theta_{2,1}$'s can be replaced by $\tan\theta_{2,1}$'s, and hence by $(\partial E_{2,1}/\partial x)$. Then the vertical unbalanced force, or the rate of change of the E-field along the x-direction can be expressed as $\varepsilon_0^{-1}(\partial E_2/\partial x - \partial E_1/\partial x)$. The horizontal unbalanced force would be $\varepsilon_0^{-1}(\cos\theta_2 - \cos\theta_1) \approx 0$, for small angle approximation. Then the final resultant unbalanced force is only the vertical force $\varepsilon_0^{-1}(\partial E_2/\partial x - \partial E_1/\partial x)$. This emerging spatially varying E-field (current) generates $\mu_0\Delta x$ quantity of temporally changing magnetic field for the element Δx. Then, by Newton's second law, the unbalanced force can be equated with the magnetic *inertial resistance* of this segment $\mu_0\Delta x$ multiplied by the temporal acceleration $\partial^2 E/\partial t^2$ experienced by this segment of electric tension filled space:

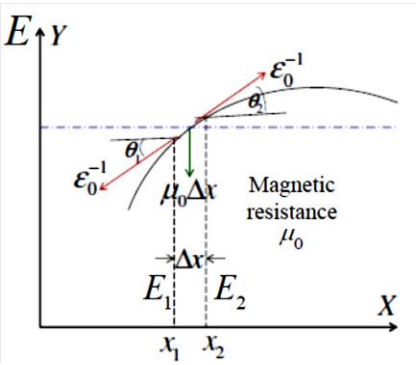

Fig. 1. Unifying classical electromagnetism with Newtonian mechanics by re-deriving Maxwell's wave equation using Newton's second law of motion. We have re-defined ε_0^{-1} as the electric tension and μ_0 as the magnetic resistance to increasing local electric current

$$\varepsilon_0^{-1}(\partial E_2/\partial x - \partial E_1/\partial x) = (\mu_0\Delta x)(\partial^2 E/\partial t^2) \tag{2}$$

By rearranging the parameters and by taking the limit $\Delta x \to 0$, we get the Maxwell's wave equation:

$$\varepsilon_0^{-1}\lim_{\Delta x\to 0}\frac{1}{\Delta x}\left[\frac{\partial E_2}{\partial x} - \frac{\partial E_1}{\partial x}\right] = \mu_0\frac{\partial^2 E}{\partial t^2} \quad \Rightarrow \quad \frac{\partial^2 E}{\partial t^2} = \frac{\varepsilon_0^{-1}}{\mu_0}\frac{\partial^2 E}{\partial x^2} \equiv c_0^2\frac{\partial^2 E}{\partial x^2} \tag{3}$$

Thus, by re-deriving Maxwell's wave Eq.3 in analogy with a classical stretched string, we have found the operational (functional) meaning behind the emergence of perpetual velocity of an EM wave in its parent tension field, the Cosmic Ether. In general, an *energetic tension field tends to stay in its energetic quiescent state*. If a disturbance is introduced at a point by some external energy, the tension field at that point immediately pushes it away to all possible spherically accessible neighboring points so that it can come back to its original quiescent (equilibrium) state as fast as it can. Then all the forward points execute the same actions to come back to their respective quiescent states. As if, the tension field is forever searching out for energy sinks to eliminate the perturbation energy, since the system cannot assimilate the external energy which triggered the original deformation on the quiescent tension field. In the absence of any frequency resonant energy sink, the process continues perpetually. Hence, a disturbance introduced on an energetic tension field, will always generate a perpetually moving wave. This engineering process (action) taking place behind wave propagation, was first presented by Huygens in his book of 1690 while describing the propagation of EM waves in free space [12], although the mathematical wave equation was developed almost a century later by Maxwell. This natural action-picture is true for all tension fields: (i) mechanically stretched tension on a string, (ii) surface tension on a water surface, (iii) pressure tension in air, etc.

By integrating Newtonian mechanics into classical electromagnetism, we have now established the *physical reality* of the electromagnetic tension properties of free space as ε_0^{-1} & μ_0, with modified physical definition as "electric tension" and "magnetic resistance", which give us the operational meaning behind the generation of perpetually moving EM wave when triggered by the movement of an electric dipole within it.

3. HOW TO EXPERIMENTALLY VALIDATE THE EXISTENCE OF COSMIC ETHER

A series of experiments by Michelson & Morley (MMX), starting from1887 [16] tried to measure the drag of cosmic ether by the earth. Michelson strongly believed that the all-pervading electromagnetic ether is real and exists. However, the results were consistently "null". Since ancient times, *the belief has been that materials exist separate from ether*. Then there must be an ether drag against material bodies.

Then the1905 paper by Einstein on Special Relativity (SR) [17] eliminated the need for ether, which was further supported by a second paper on "photoelectric effect" [18], where Einstein described EM waves as independent elementary particle-like, or "indivisible light quanta", without requiring a supporting tension field for perpetual propagation, as if c is just a constant of nature! These two papers triggered the steady evolution of a decisive physics culture that the ancient concept of ether is not correct, even though Einstein later corrected himself while defining gravity as a "curvature of space" through his theory of

General Relativity. Space needs to have some physical properties, which can be "curved". However, the physics culture has been persisting that the cosmic space is a vacuum, filled with photons, elementary particles and *vacuum fluctuations* [19], and references there], besides observable macro galaxies with stars, built out of elementary particles. However, this picture does not explain how the photons always experience perpetual, and the highest possible velocity without the support from their emitters. These obvious contradictions, along with the re-definition of ε_0^{-1} & μ_0 in the last section as the operational cause behind the perpetual motion of EM waves packets, there is an urgent need to carry out new experiments for the direct validation of the existence of cosmic ether as an energetic physical tension field.

3.1 Why MMX Experiments Cannot Discern Either the Ether-drag or the Absence of Ether?

To appreciate the limitations of MMX type of experiments, we need to pay close attention to the physical processes behind light propagation through material media and through material free Ether. Huygens, contemporary of Newton, was the first one to frame the key postulate behind the propensity of waves to propagate perpetually leveraging an energetic parent tension field. Because the tension field keeps perpetually pushing away the waves, generated through some suitable perturbation of its quiescent energetic state. In his 1690 book [12] Huygens' postulated that this perpetual propagation of a wave is generated via secondary wavelets *emanating out of every point on every wave fron*t. We usually measure the superposition effect of all these arrived secondary wavelets by some frequency resonant detector. Huygens explicitly mentioned that his model of wave propagation *process* require a tension medium (Ether) to propagate as its undulation (excitation). Section-2 of this paper has strengthened this viewpoint. Huygens also underscored that the secondary spherical wavelets do not interfere or modify each other's wave properties in the absence of any interacting medium. We have articulated this as Non-Interaction of Waves (NIW) [20,21]. In 1817, Fresnel gave a simple and elegant mathematical integral representation of Huygens Principle, now known as the Huygens-Fresnel diffraction integral (HF-DI) [13], which automatically embeds the NIW property. This is actually one of the two key mathematical foundations behind the continuous and sustained advancement of optical science and engineering, till today. There is a second foundational contribution that describes the physics behind the EM wave generation and propagation. It was given by Maxwell in 1864 [22]. It turns out that the HF-DI, a linear summation of spherical waves, is a solution of Maxwell's wave equation, as it is a second order linear differential equation. Maxwell's complete set of equations has also established a Poynting vector, $\vec{S} = \vec{E} \times \vec{B}$. The vector $\vec{S}$ on a wave front always remains orthogonal to the wave front, even when the wave front suffers tilted propagation due to tilted *refraction* in a new medium with different refractive indices (supporting different velocities).

Light also has another very interesting property. It always prefers to propagate through a structurally single mode medium of lower tension value (lower velocity with higher refractive index), whenever it has that option. This is why we have been able to invent and implement the fiber optic communication systems and sending the optical signals through single-mode glass-fiber-core of higher refractive index, surrounded by a protective glass cladding of lower index. Light remains *entrained* within the core of the glass-fiber for tens of thousands of kilometers with very little loss. Ether has the refractive index of $n_0 = 1$ and air has the refractive index $n_{air} = 1.0003$, or $c_{air} = c_0 / 1.0003$. Therefore, in the laboratory, the light beams will always be entrained by the stationary air surrounding any MMX interferometer, since air provides a relatively lower tension (higher index) medium for light to propagate. Light propagation will not be entrained by the lower index Ether, even though it is permeating through all material media and the entire universe. Hence, the propagation direction of the light beam vector $\vec{S} = \vec{E} \times \vec{B}$ in the MMX interferometer will always remain orthogonal to the pre-aligned mirrors, immersed in the laboratory air. The *propagation path cannot be tilted*, as was originally sketched by Michelson, shown in Fig. 1a [5].

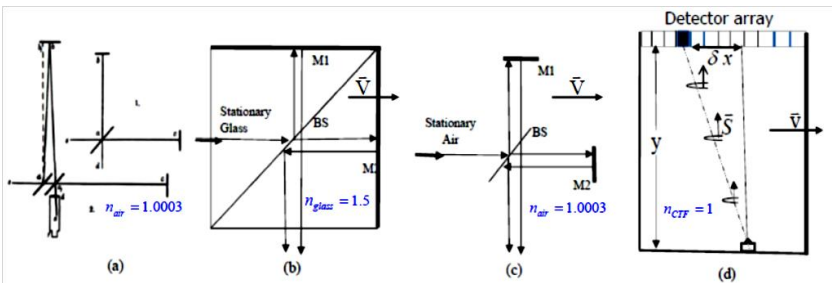

Fig. 2. Michelson Interferometer in three versions. (a) Diagram from Michelson's original paper [5]. Notice the triangular longer up-down return path of the light beam compared to the horizontal straight re-tracing path. (b) Michelson interferometer built as a solid monolithic structure out of glass prisms, mirrors and a beam splitter. Zero fringe shift is obvious from equal return paths. (c) Michelson interferometer re-drawn with equal return paths because stationary air of refractive index 1.0003 entrains the light propagation, not the aether. (d) Shift of light pulse in a one-way CTF-entrained propagation, when the apparatus moves transversely in vacuum

Fig. 2b and 2c show slightly different versions of the same Michelson's interferometer to bring out the common-sense understanding that light beams will travel straight up and down, without getting tilted. Fig. 2b is a monolithic rendition of the Michelson interferometer within a glass cube, with built-in mirrors and a beam splitter. Even if the cube experiences some velocity $\vec{V}$ in the horizontal direction due to earth's orbital velocity, or in space on a satellite, there will be no

fringe shift because the two light paths will remain identical, always entrained by the glass cube. The $\vec{\mathbf{V}}$ vector of the cube-prism cannot tilt the $\vec{S}$ vector of light away from its vertical path since the $\vec{S}$ vector is *entrained* by the assembly of the material dipoles of the glass prism of index $n_{gls.} = 1.5$. Within a material medium, $\vec{S}$ can *no longer be under the control of the stationary or even the dragged ether*. However, there will be a negligibly small Fresnel Drag [20-see Ch.11, 23] of the light beam. Because of its effective miniscule value, we will neglect the Fresnel drag in air here. The intention behind Fig. 2c is to underscore the same point, as we have done for Fig. 2b, except that the interferometer is now residing within the stationary air of the laboratory environment. Fig. 2c is actually equivalent to Fig. 2a with the correction that the light beam propagation vectors remain orthogonal to the two mirrors, without suffering the tilt assumed by Michelson, with longer travel path.

Thus MMX type of experiments should always give null-fringe result. We do not need to assign a new property on to nature that needs to trigger "length contraction" or "time dilation". If we assume that Michelson had believed ether entrained the light ray, and not the "thin" air in the laboratory, then the ether drag would have created an *apparent* tilted path for the arrival of the vertical ray and tilted return again, just as Michelson's drawing in Fig 2a. However, then the real physical tilt of the light beam would have caused *a change in the spatial frequency of the observed fringes*, *which was also never reported*.

3.2 Can we Validate the Existence of Stationary Ether?

In Section 2 we have established the deep significance for physics that we experimentally validate the cosmic space as a stationary energetic tension field. Experimental validation of Casimir Effect [24] does indicate that the space, in the nanometer domain, is not "empty". However, since the Casimir Effects have been measured only in the nanometer domains, these experiments cannot assure us of the existence of a stationary ether-like energetic tension field as the very foundation of our emergent universe. Therefore, Michelson's brilliant idea, of using the physics of light propagation over a macro distance, has to be properly re-formulated. In this section, we take lessons from the limitations of the MMX experiments and propose a simpler new experiment to determine the existence of ether. Our design should be able to compare and differentiate the measured outcomes of light propagation through some material medium and "completely" material-free ether space.

As mentioned earlier, the generic tendency of light is to choose to travel through the relatively lower tension (higher index and lower velocity) media. Further, the Poynting vector, orthogonal to the collimated optical beam, preserves its spatial direction, while obeying the basic laws of reflection and refraction. This has been pictorially shown in Fig. 2b, where the moving glass-cube-MMX preserves the orthogonal reflection of the return beams, instead of getting reflected at an angle.

We are proposing to test the presence of ether only by comparing the absence or presence of a shift in the arrival location of a *collimated light pulse through one-way travel path*, where the travel path is either filled with air as a medium ($n_{air} = 1.0003$), or is completely empty ($n_{ether} = 1$), inside a super-vacuum chamber, or on a deep space satellite. Let us now assume that the wavelength of light is λ. Then one can argue that if the average number of air molecules within a volume of λ^3 is statistically on the order of one, then the E-vector of the light beam would not experience a reduction in the effective tension value of that space. Light will now be guided as an undulation of the pure ether only, with minor amount of scattering of light from encounter with sparsely distributed individual air molecules.

We can now construct a very simple ether-sensor consisting of a rigid box (see Fig. 2d). The bottom of the box holds an LED that can send out individual pico second light pulses, on demand, vertically up to the top end. The top of the box, anchored rigidly with the LED base-structure, holds a detector array. It is designed to measure the lateral shift in the arrival position of the light pulse. If the box is full of air, the light pulse would always arrive exactly at the vertical location from the LED, even if we give the box a velocity orthogonal to the optical pulse propagation axis. However, when the box is completely free of air, either inside a super-vacuum chamber, or on a deep space satellite, a velocity of the box to the right and orthogonal to the light-pulse axis, would make the light pulse to arrive left-shifted on the detector array. This is because the Poynting vector orthogonal to the center of the original wave front of the light pulse will always follow its original straight line trajectory inside any homogeneous medium. It is now moving through stationary ether, while the box is moving away to the right.

If the length of the bar is L=1m long, then the arrival delay for the light pulse would be 3.33ns. Note that even though the dashed line of the apparent light path appears to be tilted and longer, the light pulse actually travels the same vertical distance L, while the box moves to the right. Physics of this propagation process is underscored by the vertical Poynting vectors, drawn on the cartoon-pulses, always pointing *vertically up* (Fig. 2d), while the box moves to the right.

3.2.1 Ether sensor inside a super-vacuum chamber

Let us assume that we are carrying out the experiment inside a super vacuum chamber leveraging earth's orbital velocity of $\mathrm{v} = 30 km/\sec$ by aligning the earth's velocity vector orthogonal to the light-path-vector in the ether sensor. This would generate a lateral shift of:

$$\delta x = \mathrm{v}\delta t = \mathrm{vL}/c_{air} \simeq 100\mu \tag{4}$$

Such a lateral displacement can be easily measured by an off-the-shelf linear detector array, or a position sensing quadrant detector. Several countries who are advanced in space technologies can carry out this experiment. They have large vacuum chambers with low pressure capability around 10^{-10} Torr, implying

less than about 0.1 air molecule per micron cube at typical room temperature. The visible wavelength being around 0.5micron, a vacuum of 10^{-10} Torr satisfies the effective free-space condition.

This terrestrial experiment in high vacuum chamber should also be able to establish that air in Michelson's experiment was keeping the light beam entrapped to straight path, instead of the tilted angular path assumed by Michelson, which consistently gave him the null fringe-shift results. One just need to slowly introduce air in the high vacuum chamber and observe that the light beam deflection reduces to zero at a certain pressure when there are a good number of air molecules per λ^3. The determination of this number of air molecules would be a valuable parameter in studying the fundamental physics behind the emergence of refractive index and the need for a certain number of air molecules per λ^3 to generate an 'effective continuous medium' for EM waves. *It will also validate that the EM interaction cross section of Angstrom size atoms could be one or two orders of magnate larger than the λ^2, especially when the optical frequency is in resonance with quantum level transition of the chosen gas* [25,26].

If the experiment, when carried out very carefully with the desired free-space equivalent vacuum condition, shows no lateral shift of the light spot, one possible conclusion would be that the ether is being fully dragged around its surface by the massive earth. We doubt this outcome because in our model, ether is universally stationary. EM waves and particles are the excited states of its *various emergent potential gradients, not the physical field itself*. EM wave propagation does not make the ether move. Further, the movements of material parties (or bodies) should create only changes in appropriate potential gradients around them.

3.2.2 Ether sensor on a deep space satellite

Let us assume that the orthogonal velocity of a possible deep space satellite is $\mathrm{v} = 8km/\sec$. Then the lateral displacement of the light spot would be:

$$\delta x = \mathrm{v}\delta t = \mathrm{v}L / c_0 = 26.7\mu \tag{5}$$

This is also accurately measurable using an off-the-shelf position sensing quadrant detector. Here also we are assuming that a satellite cannot drag stationary ether.

In both the above experimental environment, one could employ a second identical ether sensor with *the light vector path always aligned parallel to the box-velocity vector*. Then this second sensor should always show zero lateral shift in the arrival of the light spot. This will provide us with the extra confidence on the results of the experiments.

4. EXPLORING DIRECT UNIFYING ROLES OF ε_0^{-1} & μ_0 THROUGHOUT MAJOR PHYSICS THEORIES

In the introduction, we have presented the argument that $c_0\ [=(1/\varepsilon_0\mu_0)^{-1/2}=(\varepsilon_0^{-1}/\mu_0)^{-1/2}]$ is a *secondary* derived parameter. In section 2, we have re-derived Maxwell's wave equation while re-defining the primary *actionable parameters* of the cosmic ether as ε_0^{-1} & μ_0, electric tension and magnetic resistance, respectively. In this section, we show that these two actionable primary parameters are involved in all major theories of physics to validate our key assertion that the cosmic ether has already been functioning as the unifying field for physics.

4.1 Material Media are also Energetic Tension Fields, a Modified Versions of the Ether, ε^{-1} & μ

In section 2, after the derivation of Maxwell's wave equation, emulating the energetic mechanical tension field of a stretched string, we have explained how a tension field tries to consistently push away the external perturbation and ends up generating a perpetually moving wave. Material media also perpetually push away EM waves when they are generated inside the media, or wave pulses are sent inside them. In fact, the core properties of the EM wave propagation, including diffraction, are *mathematically very similar* in structure to those for the free space, except the values of the core parameters are modified by the aggregate properties of the material dipoles. The structure of the Poynting vector remain same. The velocity of EM waves becomes:

$$c_{med.}^2=\varepsilon_{med.}^{-1}/\mu_{med.}\equiv c_0^2/n_{med.}^2 \tag{6}$$

For most material media, usually, $\mu_{med.}\approx 1$, giving rise to the well-known relation for the refractive index, $n_{med}\approx\varepsilon_{med}^{1/2}$, determined by the collective dipolar properties of the atoms and molecules within the media. One can then surmise that, functionally, the material media also behave as modified electromagnetic tension fields. *We are then guided to postulate that the electrons, protons and neutrons, which build the atoms, and then the material media, should also represent some forms of emergent properties of the same cosmic ether.*

Let us note from Eq.6 that the velocity of light waves are slower inside the material tension fields. Hence the material tension fields are weaker than the material-free Cosmic Ether. This is why material media offer an alternate wave energy sink for the ether. This is why, given the physical proximity, EM waves will always be *pushed* inside the lower tension (higher index) material media. In fact, the atoms and molecules, having quantum mechanical frequency-resonant

energy levels, will always "*pull*" in the wave energy, while the EM tension fields will always tend to "*push*" in the wave energy, which is a perturbation to its quiescent state. This is a key point that we have utilized to explain as to why, in Michelson's ether-drag cartoon, Fig. 2 (a), the vertical light rays could not have been "dragged" by the ether! Light is always entrained by a lower tension air, even though the air molecules are emergent entities of the ether.

4.2 Emergence of Particles, Quantumness, Charge and Superposition Effect without Non-locality

4.2.1 Particles are localized close-looped in-phase (CLIP) EM oscillators

Quantum theories are functional field theories [19,27]. Ether is an energetic tension field. It also accommodates perpetually moving EM waves. We just need the right set of postulates to model the emergence of localized EM oscillators out of the same ether, which will follow Schrodinger's "wave" equation and other quantum field theories.

It is important to appreciate again the emergence of *perpetual velocity of EM wave* (or any wave) once it has been triggered on its supportive energetic tension field, which is ether for us. This will help us integrate classical mechanics with the quantum mechanics at the very foundation of the emergence of waves and material particles.

The concept is already built into the physical-process driven derivation of the EM wave equation, Eq.3. It *models the real physical processes in nature*, which engenders the perpetual motion (propagation) of a wave once triggered due to some energetic perturbation on the vast electromagnetic complex tension field, the Cosmic Ether. Eq.3 is a *linear* first order differential equation allowing for the Superposition Principle (SP). Second, it equates a temporal second derivative ("temporal acceleration") with a spatial second derivative ("spatial acceleration"). This equality, or the built-in balancing condition set by our math implies that we have correctly modeled nature – one of the fundamental tendency of an energetic tension field is to restore its original quiescent energetic state by getting rid of the perturbation energy. If it does not have built-in energy dissipation mechanism, then it will keep pushing away the perturbation perpetually because every pint of a tension field wants to stay in its energetic quiescent state (recall Huygens postulate [12]). This is the cause behind our observations that waves have tendency to move away perpetually. Now, let us look at the Schrodinger's equation, Eq.7 and compare with Eq.3. Unlike EM waves, without the presence of a separate physical

$$i\hbar \frac{\partial \psi(x,t)}{\partial t} = -\frac{\hbar^2}{2m} \frac{\partial^2 \psi(x,t)}{\partial x^2} + V(x,t)\psi(x,t) \tag{7}$$

potential gradient $V(x,t)$, Schrodinger's particle does not move spatially. However, like the EM wave equation, it is also a second order linear differential equation and hence accommodates complex amplitude-driven Superposition Principle (SP). Eq.7 has a "spatial acceleration" term, $\partial^2\psi(x,t)/\partial x^2$; but does not have a balancing "temporal acceleration" term like that for the EM wave, Eq.3. The temporal derivative term, $\partial\psi(x,t)/\partial t$, is first order. Obviously, Schrodinger's particles are not spontaneously moving wave, like the EM waves are. Schrodinger's particles are self-harmonic CLIP's. They do not need to be guided by fictitious "Pilot Waves". Their spatial movement is guided by the spatial potential gradient $V(x,t)$. The physical reason particle interactions obey the Superposition Principle (SP), $\Psi = \sum_n \psi_n$, because, being intrinsically harmonic oscillators, they would tend to trigger strong amplitude stimulations when they are frequency-resonant.

It is critically important to appreciate that this model strongly implies that ψ is a *physically real* physical state of undulating amplitude (excitation state) of a CLIP in the Cosmic Ether. It is not an abstract mathematical "probability amplitude" only; even though we have not *yet* figured out how to measure it for particles. So far, we know how to measure the final state of the Superposition Effect (SE), what we call the observable $\Psi^*\Psi$. In spite of the sustained and magnificent successes of the Schrodinger's equation, we do not know the physical picture (processes) how an excited atom succeeds in emitting a quantum of energy $h\nu$, which emerges out as a Maxwellian wave packet. This is clearly one of the foundational limitations of the otherwise, notably successful QM formalism. It is an incomplete theory, as persistently argued by Einstein.

The quantization of particle energies also emerges naturally from the famous relation, $\mathrm{E} = hf_{icl}$, the subscript "icl" is added to underscore the "internal closed-loop" electromagnetic oscillation. The stability, or the lifetime, of various particles are now determined by the degree of phase matching in the in-phase closed-loop wave propagation. Protons and electrons must have the most precisely phase-matched internal CLIP oscillations since we do not see them decay.

The phase matching requirements for the closed-looped oscillation also dictates that the energies of the stable particles cannot assume just any values. In fact, Greulich [28] has found an interesting *strongly linear* relation to express the energy of a large number of particles with measurable life times as the multiplication of an integer N with the ratio of the electron energy divided by the fine structure constant α , as in the first part of Eq.8. In the second part of the same Eq.8, we have

$$\mathrm{E}^{prt.} = N(\mathrm{E}^{el.}/\alpha); \quad \Rightarrow \; f_{icl}^{prt.} = (1/\alpha)Nf_{icl}^{el.} \tag{8}$$

re-written it in terms of CLIP frequencies. One can notice some similarity with the closed-cavity longitudinal laser mode frequencies always arise as integral multiples. For particles heavier than electrons, CLIP frequencies keep increasing linearly as some integral multiple, reduced by the inverse α -factor. This provides some extra corroboration that particles are perpetually propagating *localized* EM CLIP-modes of the Ether, somewhat like a toroidal laser oscillation.

4.2.2 "Plane wave" and "Pilot wave" are unnecessary and add only confusions

We should now clarify here that Schrodinger's complex amplitude representation, $\psi \sim a\exp[-i2\pi f_{cl}t]$, for a free particle, should have never been interpreted as a "plane wave". The conservation law tells us that a "plane wave", existing for all time and spread over all space, cannot exist in this real world. We use the very similar mathematical expression $\exp[\pm i2\pi ft]$ routinely to analyze the properties of classical pendulum, or of classical AC current oscillators. Further, the oscillatory complex amplitude property, displayed by particles, do not require any separate guidance from de Broglie's "Pilot Waves" because they themselves are CLIP harmonic oscillators, containing the necessary complex amplitudes. Originally, the idea was introduced to accommodate the wave-like superposition effects shown by particles. Besides, de Broglie's postulate has a problem of built-in mathematical non-causality (Eq.9), since the postulated wavelength of the Pilot Wave diverges to infinity as the particle velocity tends to zero:

$$\lambda_k \equiv \frac{h}{p} \Rightarrow \underset{Lt.\mathrm{v}\to 0}{\lambda_k} = Lt._{\mathrm{v}\to 0} \frac{h}{m_0 \mathrm{v}} \to \infty \tag{9}$$

We have mentioned Planck's advice in the introduction that it is important to identify the primary *action parameter* of natural entities to model their interaction processes. To model particle-particle superposition effects on "external" ("third party") detecting molecules through Superposition Principle, we need to postulate that the particles acquire a different kinetic frequency f_k (different from internal CLIP frequency f_{icl}). In particle-particle interactions, including kinetic collisions, f_{icl}, or hf_{icl} play key roles while bringing about structural transformations. We now postulate a causal de Broglie kinetic frequency f_k, defined as $(1/2)m\mathrm{v}^2 = hf_k$ which provides us with the necessary harmonic frequency and phase, $a\exp[-i2\pi f_k t]$, to model particle superposition phenomenon. The causality for the de Broglie frequency is preserved when the particle velocity tends to zero (Eq. 10):

$$f_k \equiv \frac{m}{2h}\mathrm{v}^2 \Rightarrow \underset{Lt.\mathrm{v}\to 0}{f_k} = Lt_{\mathrm{v}\to 0}\frac{m}{2h}\mathrm{v}^2 \to 0 \quad (10)$$

Recall that frequencies of oscillators are the primary characteristic parameters and are determined by the intrinsic tension property that promotes the physical oscillation.

4.2.3 Role of ε_0^{-1} & μ_0 in the fine structure constant α & emergence of charge

We should first recognize that charge is an emergent property out of electromagnetism. While we have found that mathematically the sum of positive and negative charges are always conserved in particle-particle interactions, physically, the charges can completely vanish, or emerge, as in electron-positron, or Gamma-Gamma interactions: $e^- + e^+ \rightleftharpoons \gamma + \gamma$. It is clear that we can create charge by manipulating electromagnetic gamma waves. Since γ waves are created out of ether, then the charge-property displayed by e^- and e^+ has to emerge out of some form of CLIP structure of the electromagnetic wave of the Ether that allows the formation of electrons and positrons, and hence all other elementary particles also.

Very precisely measured fine structure constant $\alpha = (1/137)$ [29] for elementary particles can be written as:

$$\alpha = \frac{e^2}{2h}\frac{1}{\varepsilon_0 c_0} = \frac{e^2}{2h}(\varepsilon_0^{-1}\mu_0)^{1/2} \Rightarrow e^2 = 2\alpha h\frac{1}{(\varepsilon_0^{-1}\mu_0)^{1/2}} \quad (11)$$

In the first part of the above Eq.11, we have re-expressed α in terms of the primary parameters ε_0^{-1} & μ_0 by replacing the secondary derived parameter c_0. Then we have re-expressed the charge in terms of ε_0^{-1} & μ_0, multiplied by the α -constant and Planck's quantization constant h, two precisely measured constants of nature. So, we have re-expressed the emergence of charge in terms of ε_0^{-1} & μ_0 (second part in Eq.11). The square of the quantized charge is inversely proportional to the square root of the product of the electric tension and the magnetic resistance, built into Ether as its key functional properties.

Notice that expressing the secondary parameter c_0 in terms of the constituent primary parameters brings back the role of the electric tension and the magnetic resistance in the formation of the elementary particles as CLIP waves. However, it tells us more. One now need to visualize the physical processes behind the

emergence of quantized charge. Somewhat similar approach are being contemplated by many scientists [30,31]. We now present some possible guiding approach to develop the CLIP particle model and the emergence of quantized charge.

Maxwell's wave equation indicates that the wave propagates as a continuously oscillating $\pm E$ -vector as if it keeps generating *emergent oscillating charge*, equivalent to an oscillating current, while triggering the emergence of a resisting orthogonal and oscillating magnetic field. Then, it is not difficult to appreciate that localized Maxwellian CLIP wave inherently contains oscillating charge and magnetic properties, which the elementary particles do display. Now the challenge is to visualize and mathematically model some localized CLIP wave structures that can display static (stationary with the particle) charge-curvatures of opposite slopes around electron and positron models (and eventually to proton models). The "spin" would be a natural consequence of the self-looped waves inside the CLIP oscillation with its own Poynting vector. *It is now conceptually clear to appreciate the emergence of quantumness in the particle world out of the 3D classical Ether*. The wave particle-duality is real, not a fuzzy logic, and it is built-in structurally and permanently, not due to some dependence on the type of experimental set up. We do not need the large number of strange, and non-causal, quantum philosophical interpretations to "understand" quantum mechanics.

4.2.4 Frequencies of CLIP particle

The rest energies of the electron and the proton are 0.510 MeV, and 938.272 MeV, respectively. Then, using $E = hf_{icl}$, and $h = 4.135\times10^{-15} eV.s$, we get the E -vector frequencies of the close-looped EM waves for the electron and proton as $f_{icl}^{el} = 1.233\times10^{20} s^{-1}$ and $f_{icl}^{pr} = 2.269\times10^{23} s^{-1}$, respectively. These oscillations for electrons and protons are in the extremely high-energy gamma-wave region, which do not spread out diffractively, unlike much lower frequency EM waves that diffract. *This non-diffractive propensity of extremely high frequency EM waves allow for the formation of stable and localized CLIP waves.* It is well validated that the diffractive spread is inversely proportional to the frequency of the EM waves. It is built into Huygens-Fresnel diffraction integral [13]. However, when the particles collide against a heavy nucleus, or each other, they would break up into a pair of gamma radiations, or other stable and unstable CLIP particles.

4.2.5 Role of ε_0^{-1} & μ_0 in determining the quantized energy levels of Hydrogen atom

Let us note that the quantized energy levels E_n of Hydrogen atoms are also guided by ε_0^{-1} & μ_0 because the inertia (mass) of electrons is due to its CLIP wave structure (Eq.12):

$$\mathrm{E}_n = \frac{m_e e^4}{8\varepsilon_0^2 h^2}\frac{1}{n^2} = \frac{({}_{el}\mathrm{E}_0\varepsilon_0\mu_0)e^4}{8h^2\varepsilon_0^2}\frac{1}{n^2} = (\varepsilon_0^{-1}\mu_0)\frac{{}_{el}\mathrm{E}_0 e^4}{8h^2}\frac{1}{n^2} \quad (12)$$

We should also underscore that the dependence of discrete energy levels on inverse n^2 implies phase dependent propagation behavior of electrons in the atomic orbits, which is mathematically well captured by Schrodinger's wave equation.

4.2.6 Locality of superposition effects

We have underscored in section 4.2.1 that wave-particle duality is a reality of nature because particles are localized CLIP EM waves. Schrodinger's QM equation represents a logically self-consistent causal relation. There cannot be sudden emergence of non-causal and non-local phenomena only when we carefully set up experiments to measure Superposition Effects (SE). Let us first underscore that the linear *mathematical Superposition Principle (SP),* $\Psi = \psi_1 + \psi_2$*, is not an observable phenomenon*. Here the operator "+" implies only coexistence, not any *interaction*. In contrast, SE is an observable phenomenon. We need an appropriate quantum detector that first responds to the joint linear stimulation $\Psi = \chi\psi_1 + \chi\psi_2$, which represents the proper *Suerposition Phenomenon*. Then the detector executes the quantum mechanical square modulus operation on both the superposed signals, $|\Psi|^2 = |\chi\psi_1 + \chi\psi_2|^2$, where χ is the linear dipolar polarizability of the detecting molecules that guides the *interaction process* between the detector and the stimulating signal. SE can becomes observable only after non-linear quadratic operation process *has been executed by a detector through absorption of energy from all the stimulating fields,* ψ_1 *and* ψ_2 *, present simultaneously.* We must not defy these valid mathematical logics just by repeating the culturally accepted belief that "indivisible single photon interfere". Further, the detecting molecules must be resonant to the incident signal frequency. Just by sending any signals ("photons") do not automatically create observable distribution of the sent signals. Further, the signals sent out, follow their own laws of propagation. EM waves diffractively spread out and particles follow linear trajectory in force-free region. CLIP particles do not diffract like the Maxwellian waves do. Therefore, the expression for SP below (Eq. 13) is just a causal mathematical expression that we are sending two streams of signal through two slits on to a distant detector array that can interact with the particles on arrival. The "+" operator in the equation does not represent any particle-particle interaction.

$$p(\tau) = a_1 e^{i2\pi f_k(t+\tau)} + a_2 e^{i2\pi f_k t} \quad (13)$$

It is simply a mathematically correct statement that we are *intending* to send two streams of particles, starting out of, say, through two slits on to a "far-field" detector array. Their arrival from the two spatially separate slits on to any specific off-axis point on the detector array will require traveling by different paths, while taking different travel times, assuming they have been pre-selected for the same velocity $(1/2)mv^2 = hf_k$. See section 4.2.1 for the definition of de Broglie frequency f_k that replaces de Broglie Pilot wavelength λ_k . The detectable (observable) energy distribution would be given by Eq.14:

$$\Psi(\tau) = \left| \chi a_1 e^{i2\pi f_k (t+\tau)} + \chi a_2 e^{i2\pi f_k t} \right|^2 = \chi^2 [a_1^2 + a_2^2 + 2a_1 a_2 \cos 2\pi f_k \tau] \quad (14)$$

Now the operation "+" within the square modulus sign is executed by the detecting elements via the interaction parameter χ . It is almost impossible for us to send exactly identical number of particles through both the slits with identical release times to make $a_1^2 = a_2^2 = a^2$ and generate pure cosine fringes with unit visibility, which is routinely assumed in making arguments in support of the magical "single particle" SE. The causally correct mathematical logics embedded in Eq.14 representing the detected "fringe intensity" (or particles number) variations defies the interpretation that a single particle can generate SE. The mathematical logic behind the presence of the product $a_1 a_2$ in the interference cross-term implies that the detector accepts energy from both the particle beams (the literal meaning of 'superposition'). We rely on the hard causality, built into our mathematics, to advance exploration of physics. Locality of superposition effect is dictated by the interaction process executed by the detectors [32-34]. Dark fringe locations are due to the resultant *null stimulations* induced on those detecting elements generated by out-of-phase multiple particles due to their mutual phase dependent stimulations. *Dark fringes are not due to non-arrival of particles in those locations*. That is what the literal meaning of the two terms within the sign of square modulus. We should not randomly defy the mathematical logic whenever we are at a loss to explain the *invisible interaction processes* that generate the registered data though interactions with detectors. Wave-particle duality (WPD) is real because particles are truly CLIP waves carrying different phases. However, WPD should not be used to justify the non-causal belief that single particle interfere. Stable elementary particles cannot make themselves appear or disappear based simply upon human constructed passive double-slit structure.

4.3 Gravity and Electromagnetism are Emergent Properties out of the same ε_0^{-1} & μ_0

We know that all "material" particles and their assembly display gravitational attractive forces, as has been modeled by Newton as a simple inverse square

law and by Einsteinian through more complex formalism as “curvature of space” (General Relativity). We also know that inertial property of a particle with Newtonian inertia (mass) can be expressed in terms of the particle’s CLIP energy and ether properties (Eq.15):

$$m_0 = E_0 / c_0^2 = (hf_{cl})(\mu_0 / \varepsilon_0^{-1}) \tag{15}$$

By definition, Newtonian mass display “gravitational curvature” around it as in Eq.16. Below, we have presented the macro mass as a summation of innumerable CLIP oscillators of quantum frequencies $f_{in}^{(1,n)}$. The issue to notice is that the mutual gravitational force between two massive bodies is *inversely proportional to both the square of the distance and the square of the electric tension of the ether* (Eq.16).

$$F = G\frac{m_1 m_2}{r^2} = \frac{Gh^2}{r^2}\frac{\mu_0^2}{(\varepsilon_0^{-1})^2}\left(\sum_n f_{cl}^{(1,n)} \cdot \sum_n f_{cl}^{(2,n)}\right) \tag{16}$$

If the CLIP wave concept for particles is correct, then the correct mathematical closed-looped light propagation model should be able to generate the gravitational force, or create the "curvature of space" (potential gradient) on the ether field. The strength of the “Curvatures of space” increases with the “closed-looped” frequencies (energies) of the particles and is directly sum-able to generate larger and *larger gravitational attraction without the need for any phase terms*, unlike for interactions between quantum particles or EM waves and particles. We do not need a separate theory of Quantum Gravity that can generate graviton for interaction through “exchange process”.

Here, we would like to introduce, without further discussions in the current paper, the postulate that all forces in nature are due to diverse kinds of curvatures in ether generated by the CLIP EM waves, without requiring the concept of exchange particles. This is simply an extension of Einstein’s definition of gravity as a “curvature of space”. We should note that interactions between diverse CLIP waves will naturally go through transient intermediate “photon-like” states as they transition from one stable CLIP wave to assume another stable CLIP structure, like for example, $e^- + e^+ \rightleftharpoons \gamma + \gamma$. Thus, Feynman’s integral technique that utilizes intermediate photons or Bosons, represent more than just a mathematical trick that just works! The method closely represents actual *interaction processes* going on in nature. *That is why Feynman-diagrams are so successful* [35].

There are many publications where the authors have claimed that gravity has electromagnetic origin [36,37]. We will briefly mention the work of one of my colleagues, Mallett [38] who has shown that Einstein’s formalism does allow for the emergence of “weak gravitational field” due to a *linear* circular laser beam intensity. Mallet has shown that a stationary neutral massive spinning particle at

the center of the ring laser will pick up a precession given by Eq.17 (see ref.36 for detailed definitions); a is the length of one of the arms of a square ring laser, ρ is the linear energy density of the laser beam.

$$\dot{\Omega} = \frac{8\sqrt{2}G\rho}{ac_0^3} = \frac{8\sqrt{2}G\rho}{a(\varepsilon_0^{-1}/\mu_0)^{3/2}} \tag{17}$$

The induced weak gravitational precession for a macro ring laser is very small, being inversely proportional to $ac_0^3 = a(\varepsilon_0^{-1}/\mu_0)^{3/2}$. Nonetheless, if a macro linear ring laser can induce inertial frame dragging on a massive particle; it is then inspiring to attempt to model a femto meter size complex CLIP 3D wave model that could generate the actually measured gravitational field strength for particles.

4.4 Cosmology: Energy Conservation, Dark Energy, Dark Matter, Expanding Universe, etc.

4.4.1 Hundred percent of the energy of the universe is held by the ether

We have defined the Cosmic Ether very much as a “classical” continuous 3D tension field with core properties being electric tension and magnetic resistance. Everything observable or manifest, consists of *perpetually propagating* EM waves – diffractively, but linearly propagating EM waves and self-looped CLIP EM waves. This perpetual propagation (velocity) is a classical property of all waves generated on a classical tension medium. It originates because the parent tension field (i) wants to preserve its energetic quiescent state by pushing away perturbations, and because (ii) it cannot directly assimilate the energies of the waves-generated perturbation. Then the sum total energy in any interaction between different CLIP waves and between CLIP and EM waves should always be conserved because the new products are also bound to be some form of waves of the Ether. This is the well observed law of conservation of energy in all interactions, an inherent property of the energetic tension field. Therefore, the Cosmic Ether must be holding 100% of the energy of the observable universe, which includes the energy of all the EM oscillations [6,20]. Thus, our CLIP model automatically supports the observed conservation of energy in all interactions.

Current cosmological theories imply that of the total energy density of the universe, Baryonic matter represent only ~5% , dark matter and dark energy supposed to consist of ~25% and ~70 %, respectively [39]. The energy density of propagating EM wave (photons) energy is negligible, only about ~0.005% . In our model, all the Baryonic (5%) matter consists of CLIP inertial waves. Then ~95% of the energy remains un-manifest in the ether, *providing the stability of the universe*. In other words, for the ether model of the universe, there is no need for Dark energy and Dark Matter [40,41] and the universe is stable.

Mannheim's work [41,42] on Conformal Gravity has argued that there is no need for Dark Matter. The postulates of Dark Energy and Dark Matter were proposed to explain cosmological issues related to balancing the total energy density in the universe. Manheim's Conformal Gravity (Eq.18), as a four-term polynomial, with four but the same fixed set chosen constants, β^* , γ^* , γ_0 and κ, can map the experimental data for the velocity distribution of the stars within a galaxy with their radial distances for about two hundred different galaxies reasonably well. One best case example for the plots of experimental velocity data points (solid dots with the error bars; using Doppler frequency shifts) for the galaxy UGC1230 is shown in Fig. 3. The solid curve is the computer plot. Other currently dominant theories of gravity do not have such broad curve fitting capability. [The dashed and dotted curves in Fig. 3 correspond to using different terms, or combination of terms, from the Eq.18. They are irrelevant for our discussions here. Readers, who are interested in Conformal Gravity, should consult ref.40 for further details.]

$$\frac{\mathrm{v}_{Tot}^2}{R} \rightarrow \left[\frac{N^*\beta^* c_0^2}{R^2} + \frac{N^*\gamma^* c_0^2}{2} + \frac{\gamma_0 c_0^2}{2} - \kappa c_0^2 R \right] \tag{18}$$

Let us re-write Eq.18 in terms of the key primary tension parameters of the Ether, using $c_0^2 = \varepsilon_0^{-1} / \mu_0$, to underscore that the origin of gravitational "curvatures of space" emerges out of electromagnetic ether.

$$\frac{\mathrm{v}_{Tot}^2}{R} \rightarrow \left[\frac{\varepsilon_0^{-1}}{\mu_0} \right] \left[\frac{N^*\beta^*}{R^2} + \frac{N^*\gamma^*}{2} + \frac{\gamma_0}{2} - \kappa R \right] \tag{19}$$

4.4.2 Cosmological redshift is not a doppler effect

Stationary Ether model also contradicts Cosmological Redshift [43,44]. For our universe to evolve causally through diverse interactions between matter-matter and matter-radiation, the values of the tension parameters ε_0^{-1} & μ_0, must remain constant. Any major expansion would appreciably change the values of these primary action parameters, and hence we would have experienced the laws of nature changing and evolving.

Further, the physical processes behind the emergence of Doppler Effect does not corroborate the conditions actually exists. The so called Doppler shifted spectral "Dark Lines" represent the absence of any physical signal. So dark lines cannot experience Doppler Effect [45]. Let us briefly revisit the origin of Doppler Effect. *Physically real and permanent frequency shift* of light as Doppler Effect happens due to the velocities of the signal-emitting individual atoms and molecules relative to the *universally stationary ether*. This Doppler-shifted signal then propagates perpetually through the ether unchanged. However, this same

Doppler shifted signal would be perceived by a set of detectors with *further modified and different Doppler shifted,* if they are moving with different velocities relative to the stationary ether. Source velocities and detector velocities both create separate Doppler frequency shifts, the former is real and the latter is apparent [45].

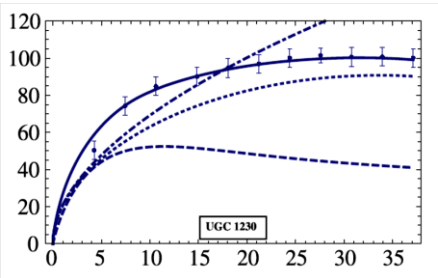

Fig. 3. Strength of Conformal Gravity model without the need for Dark Energy. Relative velocity distribution of stars with their distance from the center of the galaxy UGC 1230. The solid computer plotted curve fits very well through the experimental data points with their error bars. This is a 3D model of gravity and it does away with the need for Dark Matter [42]. It is better than the 4D model of Einstein's gravity. (The dashed and dotted curves correspond to using different terms, or combination of terms, from the Eq.18; they are not relevant for our discussions in this paper.)

Let us now account for the physical conditions behind the "frequency shifted" dark lines. First, the white light, emanating out from inside the star, must pick up the spectral dark line signatures due to the quantum mechanical *resonant absorptions* by atoms and molecules of the outer layers. Then, the emergent white light with dark lines imprinted on it, propagates through the intervening cosmic space, before reaching us. Therefore, *the frequency shift of the dark line can happen only while the entire white light spectrum undergoes redshift during its travel through the galactic space before reaching us.* The physical processes that creates this Cosmological Redshift must be some physical property of the intervening Ether whose properties have been modified due to the presence of various gravitational curvatures by the innumerable galaxies, or due to the presence of thin cosmic gases, particles and charges. This is why Hubble Redshift is an energy dissipation dependent phenomenon, not a Doppler Effect. Therefore, *our Ether model of the universe is not expanding*.

This also implies that the introduction of the cosmological constant by Einstein in his General Relativity was not necessary, because he assumed the correctness of the expanding-universe interpretation of the observed distance-dependent Cosmological Redshift, as Doppler Effect – as if, all galaxies are receding from each other.

4.5 The Postulates of Special Relativity (SR) are Automatic Consequence of the Ether Model

4.5.1 SR Postulate -1: Velocity of light is same in all inertial frames

Einstein's first postulate is essentially built into our model of the stationary Ether; a separate postulate is not necessary. However, there are some qualifications and limitations. The velocity of all EM waves in all material free regions is automatically the same, $c_0^2 = \varepsilon_0^{-1} / \mu_0$. We also have defined the Cosmic Ether as the stationary (inertial) reference frame for the entire observable universe. *It is the only universal inertial reference frame for us.* Planets, on which human-like species can carry out experiments, strictly speaking, are not truly inertial rest frames. They are continuously executing diverse complex motions: axial rotations, elliptical orbital motions and their parental stars' galactic motions (rotations and translation). However, we must note that for material media, sufficiently dense galactic gas clouds, corona of stars, planetary atmosphere, bulk material media on planets, all have different effective and *reduced tension field strength* (higher refractive index) and also have dispersive frequency-dependent velocities, $c_{med.}^2(\nu) = c_0^2 / n_{med.}^2(\nu)$. In these media, the velocities of EM waves are different. Further, if any of these media are in relative motion with respect to the stationary Ether, then the velocity suffers from Fresnel Drag [23,46].

4.5.2 SR Postulate -2: Laws of physics are same everywhere in the universe

We have already underscored that our universe, emergent in the stationary ether, is the only inertial reference frame. The only observables are propagating EM waves and localized CLIP EM waves. They all are different kinds of excited states of the same Cosmic Ether. They naturally must follow the same rules on planets in any star, in any galaxy, in the entire observable universe. Therefore, the 2nd postulate is also naturally built into our model for the Cosmic Ether. We do not need to postulate it separately.

Further, the atoms and the molecules, being assemblies of resonant oscillations of the same Cosmic Ether (CLIP modes), they naturally would obey and display the same quantum mechanical behavior in all the stars, in all the galaxies. This is also the obvious reason why the theories, well-validated by experiments on earth, also corroborate the properties of atoms and molecules in distant stars and their planets. We should further note that *the empty space between the atoms, and also within the atoms, is the same stationary Cosmic Ether, whether they are in the corona of a star, or in a discharge tube on earth.* Clearly, a separate SR theory in Physics is not of critical importance just to appreciate the universality of the laws of physics, as originally articulated by SR, which did not explicitly recognize Ether as the stationary energetic tension field.

4.5.3 SR: The running time "t" is not an operational, or a primary parameter of any natural system or object

Recall that we have underscored in the introduction the importance of "interaction process" and "primary actionable parameter" in modeling natural phenomena, because nature is persistently evolving through diverse interaction processes where the interaction parameters usually define the strength of interactions. The running time, "t" does not fit into either of this characteristic. So, it does not make operational sense to assign running time "t" as the fourth dimension of nature (the universe), having equal footing with the 3D space. The running time "t" is an ingenious invention of human culture. We cannot lead our lives without it.

Let us examine how we measure the running time. We use a standard *physical oscillator* that has a characteristic natural (resonant) frequency, f. Then we invert this frequency into a "period", "dt"="1/f". Then we keep counting larger and larger number of periods to get a semblance of running time "t". It is not an action guiding parameter of nature. Life times of radioactive elements and unstable particles do represent various physical *time intervals* as time-periods. So, the running time can be expressed as different multiples of their respective "life-times". So, the running time "t" should be kept as a mathematically convenient parameter to keep track of evolution of natural phenomenon, however, without assigning it the status of a primary action parameter of nature. We should note that, frequency being a primary physical parameter of a physical oscillator, it can be "dilated" and "contracted" by applying appropriate changes in its immediate vicinity that can alter the physical parameter that influences the resonance frequency of a physical oscillator. Therefore, the universe should not be arbitrarily defined as physically four or multidimensional.

5. APPRECIATING "EVOLUTION PROCESS CONGRUENT THINKING" (EPC-T)

In the previous sections we have shown that we need to recognize that the perpetually evolving universe is driven by causal and logical engineering interaction processes, which must require engineering tools. Our working mathematical equations incorporate these tools as interaction parameters in the equations. However, our flexible mathematical logics, by itself, cannot differentiate between primary, secondary, or tertiary, etc., parameters. This is why great scientists have always attempted and succeeded in incremental steps of integrating different natural phenomena. The successful integrations does help one to identifying common parameters and their order of engineering significance. This is where also comes human judgements. Our suggestion is to imagine and visualize nature as an engineer and try to identify the minimum possible primary tools being used, while leveraging higher degree of integration of different phenomena. This paper is a demonstration that the identification of ε_0^{-1} and μ_0 as two primary action-parameters of nature indicates that most of our successful theories are already empowered by nature's action parameters, ε_0^{-1} and μ_0.

This is why we are underscoring that our over-arching attempts to understand the very complex nature should follow Evolution Process Congruent Thinking. However, to model simpler natural process, the successes in our scientific approach has been driven by modeling and emulating interaction processes in specific natural phenomena. Therefore, it is useful to clearly identify this prevailing success-path as the Interaction Process Mapping Thinking (IPM-T) [21-Ch.12, 47-51]. Persistent successes achieved through the human invented mathematical tools, starting from Newton till the end of 1800, scientists were still using mathematics as a human invented tool to model the on-going interaction processes in nature. Unfortunately, from the beginning of the 1900, our reverence towards successful mathematical equations enhanced to the level that Bohr and Heisenberg underscored that the purpose of physics is just to validate the predictions of good theories by good experiments, not to try to figure out the invisible, but actual physical processes going on in nature. We may name this thinking as the Measurable Data Modeling Thinking (MDM-T).

Since our successful evolution and survival thrives on successful emulation of engineering process nature has already been executing, we need to bring back our older and successful tradition of modeling and visualizing the invisible physical interaction processes. We believe old fashioned IPM-T has to complement the prevailing MDM-T [41-42].

We are underscoring this point because over the last few decades many papers and books have been published [6-11] raising serious concerns that progress in physics has become stagnant for many decades after the great advances ushered in by the theories of Relativity, and Quantum Mechanics since the beginning of the last century. We believe this is because we have started to neglect that nature is constantly executing real physical interaction processes to nurture its perpetual evolution. No finite set of theories and experiments can succeeded in finding the complete set of properties of any natural entity triggering diverse natural phenomena. This has been mathematically articulated by Gödel's in his Incompleteness Theorem [52].

Let us underscore the significance of bringing back the old fashioned IPM-T. Both the Cosmosphere and the Biosphere are perpetually evolving through marvelous recycling engineering activities from "dust to dust". Biological bodies of all species thrive on physical and chemical engineering activities, some of which are genetically coded. Children show engineering propensities at all possible opportunities. Since ancient times, the rapid human evolution have always been triggered by engineering innovations, irrespective of whether we have fully understood the laws of nature, or not. Today we are in the Knowledge Age and we have created a Global Village by virtue of the global fiber optic network. The fiber optic system thrives upon our mastering the engineering processes behind the generation, modulation, propagation and detection of electrons and photons. Yet, none of us can still claim that we really understand what the electrons and photons are. Thus, the engineering skills of mastering nature allowed processes is the best guide for us to assure our sustainable evolution.

6. CONCLUSIONS

Galileo and Newton ushered in the golden days of physics-thinking by elevating the need to validate the reproducible experimental data after constructing mathematical theories that can explain the operational functions behind the emergence of natural phenomena. After several centuries of outstanding and rapid progress, physics has now become a bit moribund [6-9], except for our steadily accelerating engineering capabilities. This has encouraged us to imagine nature as a profoundly creative system engineer. Accordingly, we have approached to dissect the working theories while searching for the primary operational parameters in them. This approach has also been strongly espoused by Plank [14], as has been mentioned in the introduction. While searching for the appropriate action parameters behind the perpetual velocity of light in the cosmic "vacuum", which is built into Maxwell's wave equation, we are able to identify them as (electric tension) & (magnetic resistance). Once we combine this with Einstein's matter-energy inter-convertibility relation, $m_0 = E / c_0^2 \equiv E(\mu_0 / \varepsilon_0^{-1})$, we have been naturally guided to postulate elementary particles as CLIP oscillatory modes of the same Cosmic Ether. Then we have strengthened and justified, using various mathematical expressions out of different working theories, that the Cosmic Ether has always been the unifying platform for our observable universe nurturing diverse kinds of oscillators of it. EM waves are freely propagating excited states of the ether. The particles are closed-looped in-phase (CLIP) modes of the Ether, which are spatially constrained as localized harmonic oscillators with complete inertia to motion in the absence of any spatially influencing potential gradients (forces) in its vicinity.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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