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The constancy of "c" everywhere requires the cosmic space to be a stationary and complex tension field

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ABSTRACT

Atoms and molecules that emit light, do not impart the ultimate velocity "c" on the emitted photon wave packets. Their propensity for perpetually propagating at this highest velocity in every possible direction must be leveraging a sustaining complex cosmic tension field (C^2TF; ether of past centuries), which constitutes the space itself and hence stationary. Then the null results of Michelson-Morley experiments, positive and the null results of Fresnel-drag experiments and the positive Bradley telescope aberration should be explained as a drag of the C^2TF by the Earth. We support this previously rejected hypothesis through various self consistent arguments and experiments. We present a null result for longitudinal Fresnel drag, in contrast to Fizeau's positive result; since we did not introduce any relative velocity between the light source and the phase-delay introducing material in our interferometer. We also propose that C^2TF has a built-in weak dissipative property towards electromagnetic waves, so its frequency decreases very slowly with the distance of propagation through the C^2TF. This hypothesis would eliminate the need for an *expanding universe*. We recast Hubble constant to accommodate the required Doppler shifts. The observable manifest universe consists only of EM waves and material particles. For C^2TF to provide the unifying substrate for a new filed theory, we need to hypothesize that all stable particles are localized complex 3D non-linear, resonant but harmonic undulations of the C^2TF. The non-linear strengths of the localized resonant undulations also introduces spatially extended but distance dependent distortions around the site of the resonances. These *distortions* are effectively different kinds of potential gradients manifest on the substrate of the C^2TF, giving rise to the various forces. We now recognize four of them. The origin of *mass* is purely the inertia of movement of these resonances along these different potential gradients they experience. We further assert that the notion of self-interference, either for EM waves, or for particles, proposed in support of the hypothesis of *wave-particle duality*, is logically inconsistent with our currently successful mathematics and hence we should abandon this unnecessary *duality* hypothesis within the formalism of current QM.

Key words: What are photons; Complex cosmic tension field; Cosmological red shift; Null Michelson-Morley result; Null Fresnel drag; Particles as 3D resonant undulations; Mass as inertia of motion; Removing wave-particle duality.

1. INTRODUCTION

A careful investigation of a wide variety of light-matter interaction processes (optical phenomena) and passive light manipulating processes (imaging, focusing, diffracting, etc.) clearly suggests that the propagation of EM energies at all frequencies are basically carried by wave packets that always travel at the highest possible velocity crossing the entire galactic distance without the help from the parent emitter. The diffractive spreading of EM signals being inversely proportional to the frequency, the radio waves suffer maximum spreading displaying wave properties and the γ-rays suffer minimum spreading displaying particle-like properties. Our interpretation of these distinctly different wave and particle-like properties are also dictated by the intrinsic characteristics of detectors that can respond and interact with these different EM waves.

Something must be helping the EM wave packets to propagate with the velocity "c" through the galactic distances, while crossing through each other, or co-propagating with each other, and yet preserving the parental information, atoms or molecules, which have emitted them. Thus, this process-based thinking to understand nature immediately helps us hypothesize two things about nature that we have been avoiding accepting openly and formally: (i) Non-Interaction of

waves (NIW), or that EM waves must not interact with each other in the linear domain in the absence of some suitable facilitating material medium [1]. (ii) Second, that the space must be a very rich medium that perpetually propels EM wave pulses, once emitted, and yet allows all other material particles to freely travel through this cosmic medium, basically unperturbed. The second hypothesis, that space must be a medium, has been a continuous debate since ancient times, reaching its peak during late 1800's (as ether) and then slowly dying out during early 1900's (no ether; null Michelson-Morley experiments) and then re-emerging as a subject that has been raised by many [2-4]. The hypothesis of the NIW-principle has already been proposed and developed to some degree of maturity [5-7].

In this paper, we are "hanging out on a limb" regarding the concepts, because we are stretching our logical imaginations beyond our expertise in optics! That is why it is a research paper, and not just an extension of currently accepted theories. However, we will consistently attempt to justify our position through consistent logical congruency, observations and experiments. We believe that we must consistently seek after *cosmic logics* behind the perpetual evolution of the cosmic system. All of our successful theories that have helped us extend our knowledge about some of the workings behind this cosmic evolution, have been based on *human logics* (logical hypotheses) and human invented *mathematical logics* to give well bounded structures to the initial set of hypotheses and evolve as predictive theories. This paper proposes and justifies that the space is the final frontier for physics because everything manifest in this universe is some form of undulation of this medium, which is a universal but a very complex tension field. We call it the Complex Cosmic Tension Field, or C^2TF. The concept has been proposed before [8]. This paper presents further extension of the C^2TF hypothesis.

Section-2 summarizes the proposed characteristics of C^2TF to unify the origin of EM waves and particles. Section-3 discusses the various ether drag experiments and proposes that C^2TF (modern ether) is dragged by the earth. Section-4 presents arguments why elementary particles should be considered as various localized 3D non-linear harmonic undulations of the C^2TF. Section-5 utilizes one of these internal harmonic undulations frequencies as being linearly proportional to its kinetic energy and replaces de Broglie wave concept by this internal frequency. Thus, the C^2TF hypothesis helps us remove the wave-particle duality. Section-6 proposes that C^2TF has a dissipative character towards EM waves causing them to lose energy and hence become red-shifted in their long journey through the cosmic distance. This eliminates the need for an expanding universe.

2. PROPOSED HYPOTHESIS - A UNIVERSAL TENSION FIELD

Foundation behind most of the successful theories of physics is the concept of field, starting with Faraday's lines of forces in free space. Ancient Electrostatics taught us that the free-space has a physical property ε_0, we call dielectric constant**.** Magnetostatics gave us the physical property of magnetic permeability of free-space μ_0. Maxwell's Electromagnetism set the velocity of light in free-space in terms of the free-space properties $c^2 = 1/\varepsilon_0\mu_0$. The measured value of the dielectric constant inside any material medium ε is generally almost always less than ε_0**,** hence the velocity of light is the maximum in the free space, epitomized by the Special Relativity. Einstein's definition of mass $m = E/c^2 = E\varepsilon_0\mu_0$ clearly corroborates that the property *mass* is some form of joint manifestation of the tenuous dielectric constant and the magnetic permeability of the free-space. We also know that the Gravity in General Relativity appeared mathematically as the *curvature of space* (some gradient in a potential tension field?). QM, QED, QCD and String theories have some built-in field concepts. It does not make sense to negate that the cosmic space is some form of Complex Cosmic Tension Field, or C^2TF [8].

The manifest universe, so far, observable to us, is built out of EM waves and assembly of localizable elementary particles which form Angstrom size atoms. Macro material universe is just various assemblies of diverse atoms. To successfully develop a universal unified field theory, we must first hypothesize a suitable universal field that can logically allow the integrated manifestation of both perpetually propagating EM waves and localized particles that can exert their own influences on the same universal field facilitating the management of their own movements, while allowing for the continuous evolution of the magnificent universe for us to experience, enjoy and slowly learn about it in which we are just an assembly of trillions of miniscule undulations of C^2TF! So, space is the final frontier for physics! It is not empty. EM waves constitute the simplest possible perturbations of the C^2TF and hence it propagates with the highest possible velocity, leveraging the intrinsic electromagnetic tension-restorative characteristics already known to us as ε_0 and μ_0, except in regions where the presence of secondary perturbations reduces the local effective value of the electromagnetic tension components. Stable elementary articles are localized harmonic but complex non-linear resonant

undulations of this C^2TF leveraging several sets of tension-restorative field characteristics giving rise to measurable properties like charge, magnetic moment, spin, etc., etc. Their stability comes from resonances even when they form more complex systems out many elementary particles, which also lie at the root of quantumness in our material world while accounting for the success of QM theories. Thus, inventing mathematical formalism to generate several different kinds of localized resonant harmonic undulations that can leverage a complex tension field with built-in multiple restoring reactions, will lay the foundation of a potentially new unified field theory from the single substrate, the C^2TF. These localized resonant undulations have 3D spatial extension creating different new tension gradients around them as perturbations over the C^2TF. So far, we have identified four such distinct gradients around particles which make other particles move or "fall" through these gradients. We call these regional gradients four forces: (i) the Gravitational gradient, (ii) the Electromagnetic gradient, (iii) the Strong nuclear gradient and (iv) the Weak nuclear gradient. There may be other subtle gradients waiting to be discovered! The C^2TF, being a tension field, holds the 100% of the cosmic energy as potential energy. Most likely only about 4 to 5% of this tension field energy is manifest as observable waves and particles; the rest of the tension field provides the stable substrate for the manifest universe to keep on evolving by cycling and recycling through diverse galaxies, stars, planets and biospheres! This may help reduce the need for the ad hoc hypotheses of dark energy and dark matter.

2.1. Faraday's field concept

Faraday (1791-1867) was the first one who formalized the concept of field and the density of field lines to explain electro static, magneto static forces and their remote influence on material bodies when they move relative to each other, which facilitated the invention of electric current generators and electric motors. Consider a simple experiment that we show in the primary schools to get the children interested in science and technologies. A pair of annular magnets with the same polarity facing each other helps defy the gravitational downward pull of the upper magnet (Fig.1). It is obvious that the space between the two ring magnets possesses both the *gravitational tension field* and the *magnetic tension field*. The gradients in these two tension fields, gravitational attraction and magnetic repulsion, must be balancing each other to keep the upper ring magnet floating is *empty space*! A human finger or a wooden blade, passing through the space between the two magnets, does not show any changes; the two fields remain unperturbed. But if we try to slide a steel blade through the space between the floating magnets, the two magnets snap together. Of course, we know that a steel blade, being a *magnetic material*, is capable of changing the *magnetic tension field* around it; but our experience tells us that the *gravitational tension field* remains effectively unperturbed within our easy measurement capability! Our point is that if we look at our everyday experience with open mind, we can appreciate that the space simply cannot be *empty!*

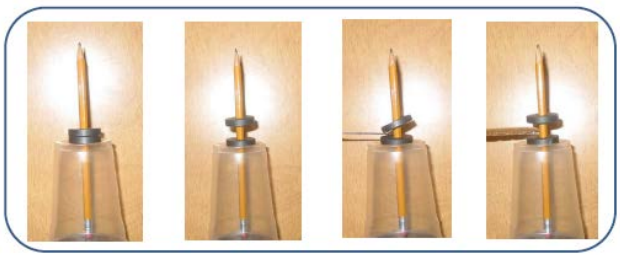


Figure 1. Space is not empty. A kindergarten experiment to remind ourselves that the space between a pair of magnets with same poles facing each other floats and the space in between contains magnetic and gravitational fields.

2.2. Comparing electromagnetic and mechanical tension fields: The equation for the velocity of propagation of a mechanical wave sustained by a string under tension and that of EM wave is remarkably similar with some subtle difference. For a string T is its tension force and σ is the restoring force per unit length:

$$\frac{\partial^2 y}{\partial t^2} = \mathrm{v}^2 \frac{\partial^2 y}{\partial x^2};\ \mathrm{v}^2 = \frac{T}{\sigma} \tag{1}$$

For EM waves, we never explicitly present ε_0 and μ_0 as some form of tension and restoring field, but, let us do so. Because of the historical ambiguity, we can choose either ε_0^{-1} or μ_0^{-1} as the tension force and the other one as the restoring force. We prefer ε_0^{-1} as the tension force and μ_0 as the restoring force since our EM wave detection processes dominantly

involve some electric dipole stimulations. Further, the velocity of EM waves gets reduced in a medium, consisting of material dipoles with the bulk dielectric constant as ε :

$$\frac{\partial^2 E}{\partial t^2} = c^2 \frac{\partial^2 E}{\partial x^2};\ c^2 = \frac{\varepsilon_0^{-1}}{\mu_0} = \frac{\mu_0^{-1}}{\varepsilon_0} \tag{2}$$

In fact, we can emulate the derivation of the wave equation for a stretched string and reverse derive Maxwell's wave equation as if ε_0^{-1} and μ_0 pair represents the tension and restoring forces:

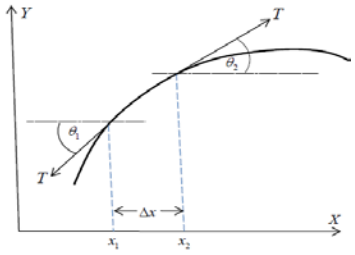


Figure 2. Derivation of the wave equation for a stretched string.

The wave equation for a string under tension is derived by equating two balancing forces. Mass times the acceleration of an elemental string length equals the restoring tension force. Displacement of string position is "y".

$$ma = F \tag{3}$$

$$(\sigma \Delta x)\frac{\partial^2 y}{\partial t^2}(x,t) = \Delta_x (T \sin\theta) \approx T \Delta_x (\frac{\partial y}{\partial x}) \tag{4}$$

$$\sigma \Delta x \frac{\partial^2 y}{\partial t^2}(x,t) = T \Delta_x \frac{\partial y}{\partial x} \ \Rightarrow\ \frac{\partial^2 y}{\partial t^2}(x,t) = \frac{T}{\sigma}\frac{\partial}{\partial x}\frac{\partial y}{\partial x}(x,t) = \mathrm{v}^2 \frac{\partial^2 y}{\partial x^2}(x,t) \tag{5}$$

$$\frac{\partial^2 y}{\partial t^2} = \mathrm{v}^2 \frac{\partial^2 y}{\partial x^2};\ \mathrm{v}^2 = \frac{T}{\sigma} \tag{6}$$

We now inverse derive classical Maxwell's wave equation for EM waves to bring conceptual congruence with the proposed tension filed. Eq.8 and 4 represent the similarity, where $\mu_0 \Delta x$ is the restoring force per unit displacement:

$$\frac{\partial^2 E}{\partial t^2} = c^2 \frac{\partial^2 E}{\partial x^2} \ \Rightarrow\ \frac{\partial^2 E}{\partial t^2} = \frac{1}{\varepsilon_0 \mu_0}\frac{\partial}{\partial x}\frac{\partial E}{\partial x} = \frac{\varepsilon_0^{-1}}{\mu_0}\frac{\partial^2 E}{\partial x^2};\ c^2 = \frac{\varepsilon_0^{-1}}{\mu_0} \tag{7}$$

$$(\mu_0 \Delta x)\frac{\partial^2 E}{\partial t^2}(x,t) = T \Delta_x (\sin\theta) = \varepsilon_0^{-1} \Delta_x (\frac{\partial E}{\partial x}) \tag{8}$$

$$\frac{\partial^2 E}{\partial t^2}(x,t) = \frac{\varepsilon_0^{-1}}{\mu_0}\frac{\partial}{\partial x}\frac{\partial E}{\partial x}(x,t) = \mathrm{c}^2 \frac{\partial^2 E}{\partial x^2}(x,t);\quad c^2 = \frac{\varepsilon_0^{-1}}{\mu_0} \tag{9}$$

We should note that Schrödinger's equation is really not a wave equation:

$$\frac{\partial \psi(x,t)}{\partial t} = -\frac{\hbar}{i2m}\frac{\partial^2 \psi(x,t)}{\partial x^2} \qquad [+\mathrm{V}(x,t) \text{ potential gradient must be added to move a particle!}] \tag{10}$$

It does not directly represent propagation of any waves manifest in any tension field until we separately add a separate gradient $\mathrm{V}(x,t)$ that stimulates the "fall" of the particle. There is no acceleration term or second derivative of $\psi(x,t)$ with respect to time!

2.3. Appreciating the propensity of perpetually propagating waves and availability of tension field energy:

A uniform tension field tends to stay at its lowest energy state of unperturbed equilibrium. When an external energy sharing agent, capable of interacting with the tension field, imparts any perturbation, the tension filed attempts to get rid

of the disturbing energy, but all it can do is to hand over the energy to the neighboring region all around it and try to get back to its original state of equilibrium as soon as it can. The perturbed points in the surrounding region does the same to get back to the state of equilibrium. As this process goes on, we have a perpetually propagating wave packet moving away from the original site. Thus, the diffractive propensity of a propagating wave packet is automatically built into the process of *propagation-tendency* of a wave as has been well captured by the Huygens-Fresnel principle, compatible with the Maxwell's wave equation. In the linear domain, the wave packet solution is naturally a sinusoidal oscillation. The propagating wave packet carries off the original perturbation energy, but only by leveraging the tension field energy at every forward location while being assisted by the tension field that wants to "get rid of" all the unwanted perturbation energy. Thus, wave packets are necessarily a *collective phenomenon* extending over a certain amount of 3D space. Being a spatially extended *collective phenomenon*, a spatially modifiable gradient in the tension field can modify the wave packet to converge, diverge, reflect, etc., which we do using lenses, mirrors, prisms, etc.

Such a propagating wave packet makes the local tension field energy available for any other entity that can interact with this wave-perturbation, which would not have been available otherwise out of C^2TF. Accordingly, the enormous amount of energy held by the proposed C^2TF is not yet available for us to sense or measure because only the manifest wave packets and particles can interact with each other and convert energy from each other while undergoing physical transformation to become measurable and quantifiable.

In support of the generic tension field hypothesis, let us mention other waves, which are observable in different visible material medium, in contrast to the invisible C^2TF. (i) **Water waves** – leverage surface tension and the gravitational tension of the water. **Sound waves –** leverage the pressure tension of air molecules (as a result of gravitational attraction on the air molecules). **String waves -** leverage the mechanical tension (stretching) applied on a string. **Etc.**

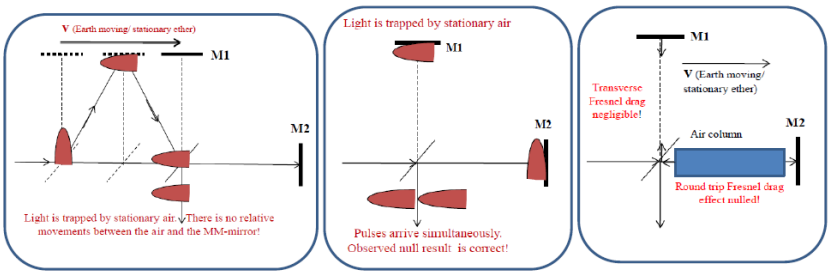
Since the propagating waves are the linear sinusoidal undulations of a sustaining tension field, unlike non-linear particle-resonance oscillations, they do not generate any non-linear gradients around them. This is why propagating waves do not have the capability of interacting with each other and hence they cannot induce any transformation on each other resulting on spatial or temporal energy re-distribution. They pass through each other unperturbed and without any *interference* effects on each other. We call this generic property of tension field based waves as the NIW-property, already mentioned earlier [1].

3. INVESTIGATING THE FAILURES TO DETECT ETHER OR C^2TF

For over a century and a half, scientists have been trying to validate the ether hypothesis as some *substance*. The attempts have been basically unsuccessful. Our proposed C^2TF is substantially different. It is a tension field in which our manifest physical universe consists of (i) propagating EM waves and (ii) non-propagating resonant local undulations. By definition, these entities cannot directly validate the existence of C^2TF as they cannot directly interact with C^2TF anymore to exchange energy and generate detectable transformations for us to detect. It is like one ocean wave is asking another ocean wave, "Do you know what you are made out of?" It is not surprising that even at extreme velocities; the Large Hadron Collider needs to make two particle beams collide against each other to bring about observable transformations. Thus logics and imaginations are the only tools left for us to keep on searching for "what we are made of"!

3.1. Null result for Michelson-Morley (M-M) experiment does not invalidate the existence of the C^2TF

If we hypothesize that material particles drags the C^2TF with a slowly dying velocity gradient with the radial distance, then it is equivalent to ether being dragged. On the surface of the earth, ether or C^2TF is stationary with the lab set up. Hence, there is no need to calculate the extra distance traveled by light as in Fig.3a. The light beams will always arrive with the same relative phase delay after the round trips in each arm of the M-M interferometer as shown in Fig.3b. When the interferometer is in air, the air columns and the C^2TF column being co-stationary, no differential Fresnel drag can



(a) (b) (c)

Figure 3. Michelson-Morley interferometer presented with differently to underscore different issues. (a) represents the origin of traditional extra path delay experienced by light in one arm. Our point is that the null result corroborates ether-drag and the relative delay is zero, as shown in (b). In (c) we show that due to round-trip arrangement of M-M experiment, it could not have detected Fresnel drag, if existed.

also take place. Thus null results in M-M like experiments can only mean that C^2TF is stationary near the surface of the earth. But this drag has to fall off to zero at sufficiently large distance from the surface of the earth. Thus there has to be slowly increasing differential velocities between a stationary M-M set up at very high altitude and C^2TF. Could this be the reason why high altitude experiments show some residual fringe displacement [9], possibly, due to transverse Fresnel drag?

3.2. Positive Fresnel's ether-drag, as measured by Fizeau, takes place only when water moves with respect to the light source!

Fizeau designed a brilliant two-way circular interferometer [10], like that of the Sagnac, to obtain a *positive* result by giving a finite velocity to the water inserted inside the interferometric path. The approach also avoided any controversy that could have been introduced by the velocity of the Earth due to axial spin and orbital rotation around the Sun, which is nullified by the bi-directional circular propagation of light! Fresnel derived his proposed drag based on arguments of electromagnetism consisting of two components, (i) stationary ether with the velocity determining factors for free space ε_0 and μ_0 and (ii) the changes on the values of ε_0 and μ_0 due to polarizability of the moving dipole assembly of the material:

$$u' = \frac{c}{n} \pm \mathrm{v}_{erth}\left(1 - \frac{1}{n^2}\right) = \frac{c}{{}_{drg}\,n} \tag{11}$$

This is also derivable from Einstein's velocity addition theorem, neglecting (v^2 / c^2) terms:

$$u' = \frac{u \pm \mathrm{v}}{1 \pm u\mathrm{v}/\mathrm{c}^2} \tag{12}$$

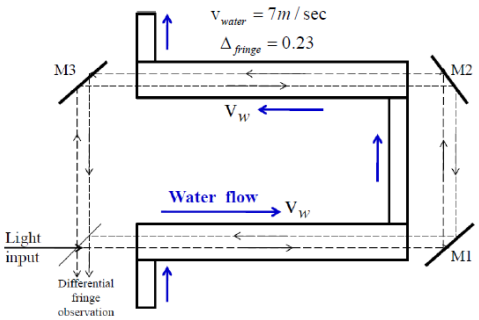


Figure 4. Fizeau found clearly measurable positive fringe shift quite close to that predicted by Fresnel using a two-way circular interferometer while imparting velocity to water in the tube. The fringe shift implies as if the ether (C^2TF) is being dragged by moving water.

3.3. Null Fresnel drag in the absence of relative velocity between the interferometer light source and the material in its arms.

It is clear from the positive Fresnel drag result that ether (or our C^2TF) is being dragged by the moving water, while the light source remained stationary with respect to the interferometer. So, we wanted to test whether the axial spin velocity and the orbital rotational velocity of the Earth around the Sun can introduce any Fresnel drag due to a block of glass inside an interferometer. By virtue of our hypothesis of complete drag of ether (or C^2TF) on the surface of the earth, it should be null. But, we recognized that we cannot emulate Fizeau's two-way ring interferometer of Fig.4 for our experiment. It is null by design by Fizeau, as mentioned earlier. So, we set up a simple Mach-Zehnder interferometer with a glass block in one arm and air in the other. This is a one-way comparator interferometer shown in Fig.5. The light source and the glass block remain relatively stationary to each other on a small optical table sitting on a turntable free to rotate 360^0.

We have carried out this one-way comparator interferometer experiment and the result was null, $\Delta_{fringe} = 0!$, as we expected from our hypothesis of drag of C^2TF by the Earth. The results are shown in Fig.6. The stationary glass block had a length of 11.5cm, which should have produced a shift of about ~40 fringes due to earth's 30km/s orbital velocity as we rotated the interferometer by 180^o. The rotation was such that in one orientation, the laser beam travels through the glass block from the East to the West direction, then to the West to the East direction.

The drag of C^2TF accommodates both the null results of Michelson-Morley and the theory of Special Relativity. Further, our inability to interferometrically measure the relative velocity between the Earth and the Sun also implies that C^2TF is completely stationary on the surface of the Earth. The velocity addition theorem of Special Relativity applies to Fizeau's experiment when there is a relative velocity between the light emitter (source) and the delay-generating material medium (flowing water). The Earth's velocity with respect to the Sun is not experienced by our glass-block because the complete drag of C^2TF makes the relative velocity between the source and the glass-block zero. Alternate way of saying is that water moved relative to stationary C^2TF in Fizeau's experiment, but our glass-block remained stationary with respect to the C^2TF.

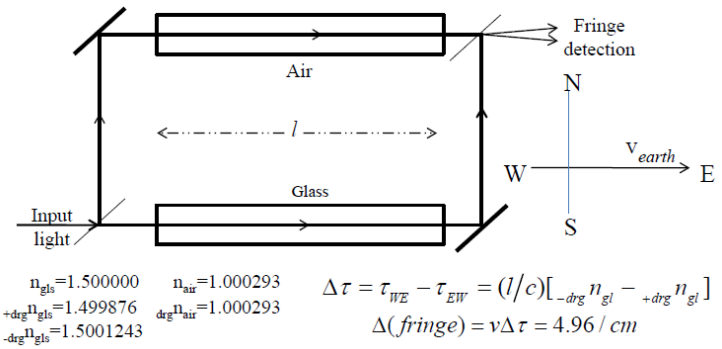
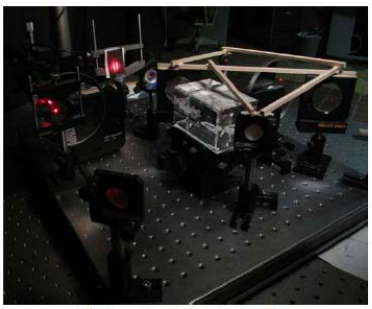
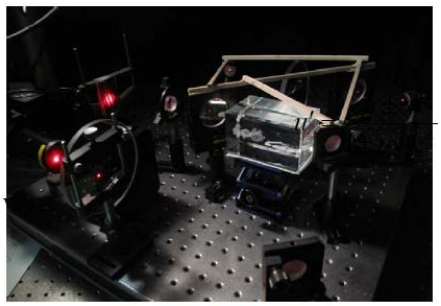


Figure 5. One-way comparator for relative phase delay between two arms of a Mach-Zehnder interferometer. One arm contains air, the other arm contains a glass block. The purpose was to find out relative phase delay due to Fresnel drag by the glass block that could be introduced due to the velocity of the earth. As expected from the ether drag hypothesis, the result was null.



Light traveling from West to East



Light traveling from East to West

Figure 6. Null result of Fresnel drag due to a stationary glass block (fore- ground) in one arm of a Mach-Zehnder interferometer. Unmoved fringes are visible in the back ground (fixed stationary screen on the interferometer table) while the interferometer block was rotated through 180^o sitting on a turntable.

3.4. Do we really understand the physical significance of the velocity addition theorem?

We have seen in the last section that in interferometric experiments, relativistic velocity addition theorem works only if the there is a relative velocity between the light source and the delay-inducing material in the interferometer arm. We cannot measure the velocity of the earth's orbital motion by this method. So, it is worth pondering over the limitations of working theories. We have been promoting the Interaction Process Mapping Epistemology (IPM-E) for doing physics so we can emulate the physical processes in nature to innovate novel technologies to keep the accelerated pace of human evolution [11]. If we do not fully understand the deeper physical meaning of a working theory, it is legitimate for us to question the utility of the foundational hypotheses behind such theories until we start understanding the invisible interaction processes that is being mapped by the working theory. If we cannot discover any interaction processes behind the phenomenon modeled by the theory, it is legitimate to question whether the theory really predicts the correct measured result by coincidence or not.

Consider a simple example of a pair of two-story high elevators; one is stationary and the other one is moving up as normal. A stationary observer from the top floor is computing the absolute and relative velocities of two robotic persons walking up the two elevators with absolutely identical personal speed, say, two-elevator-steps per second. Obviously, the person walking on the moving elevator will have faster relative velocity than the person walking up the stationary elevator. The observer, of course, can apply the velocity addition theorem for the person walking up the moving elevator. At low velocities of the elevator and the walking person, Einstein's velocity addition theorem converts to the Galilean velocity addition theorem as we do in our daily lives. If I now imagine that the speed of the moving elevator and that of both the robotic persons have increased very close to that of light, of course we will claim that the velocity addition theorem will work because it has been found to work for accelerated elementary particles. Does it really matter from the perspectives of the two robotic persons? Both of them have been walking with the same speed (low or very high) with respect to the elevators! Does the electromagnetic properties of the body molecules of the person walking on the moving elevator would behave differently than those of the person walking on the stationary elevator? Their movements relative to the local C^2TF becomes a relevant issue.

To further challenge the reader in thinking towards physical relevancy of our theories, let us consider how we calculate the relative velocity of light in Michelson's East-West Beam-splitter & mirror combination (see Fig. 7 below and also Fig.3 above):

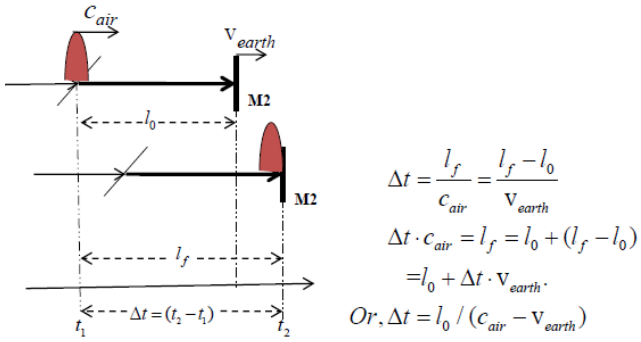


Figure 7. This diagram shows the different apparent positions of the M-M interferometer mirror that moves with the velocity of the earth (see fig.3). The idea is to show that the same time interval can be mathematically expressed in terms of different measurable parameters. The purpose is to alert the reader to appreciate that all mathematically correct expressions may not represent real physical pictures of the phenomenon under study.

The time interval Δt, required for the light pulse to catch up with the MM-mirror, can be expressed in three different ways using three different effective velocities. Does the effective velocity $(c_{air} - v_{earth})$ really exist and be taken in the same footing as the two real velocities, c_{air} and v_{earth}? Which ones represent physical realities and which one represent

only mathematical reality? We must not abdicate visualizing or mapping the physical reality in favor of elegant mathematical expression, simply because it is mathematically simple! [12]

3.5. C^2TF drag is supported by visualizing the atomic corral recorded by AFM pictures

We already know that atoms and electrons do not have sharp boundaries. The advent of nano technologies are now giving us deeper glimpses behind the workings of atoms and molecules. Consider the two corrals of atoms arranged by nano tip tools and pictured by scanning AFM. The extended boundaries of all the atoms clearly influence each other to create superposition patterns of resultant extended fields (Fig.8). The symmetric patterns of extended *fields* around the arranged atoms clearly indicate that organized collective extension of the fields of the patterned atoms can be considered as modified C^2TF that stays with the individual atoms. Of course, the extended beautiful *superposition patterns of fields* have been facilitated by the atoms of the surface of the substrate. But, the extended influence of the fields due to the symmetrically placed individual atoms through many atomic distances is clear. From our existing knowledge of atoms getting self-organized to form crystals out of solutions, the corral pictures below make perfect sense. Now, our point is this. These recorded corral patterns, extending beyond many atomic diameters, were stationary in the lab, otherwise these slow meticulous measurement could not have been registered. 30km/sec earth's orbital velocity clearly did not distort these corral patterns. Can we hypothesize that this may be an indirect validation that material particles, being undulations of the C^2TF, drag the C^2TF with it around its immediate vicinity?

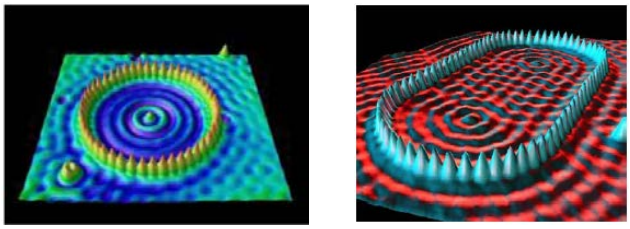


Figure 8. Quantum Corrals of atoms in two different arrangements. The idea is to help reader appreciate that there are spatial extended modifications of *fields* around atoms, which are dragged along by the assembly of atoms without being perturbed by the high velocity of the Earth around the Sun.[from web]

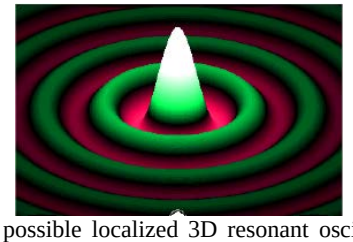


Figure 9. A pictorial cartoon to represent one possible localized 3D resonant oscillation of the C^2TF representing an elementary particle. In reality, our proposed undulation is a lot more complex including rotations. [From the web of Gabriel LaFreniere].

4. IN SUPPORT OF PARTICLES AS LOCALLY RESONANT UNDULATION OF THE C^2TF

It now requires only a few small steps of imaginations to visualize elementary particles as localized 3D resonant harmonic undulations of the C^2TF. Fig.9 shows a 3D visualization of such a proposal taken from the web. The crests and the troughs harmonically oscillate up and down, its center of gravity remains stationary. This concept of resonance is indirectly corroborated by Greulich's work [13] where he presents the energies of most of the particles as integral N multiple of that for an electron: $E_{particle}/E_{electron} = N/2\alpha$ where α is the fine structure constant (= 1/137.036).

We hypothesize that such nonlinear resonant oscillations also generate different physical potential gradients on the C^2TF corresponding to various forces and hence they can facilitate (impose) attractive or repulsive translation on nearby particles. If stable particles are truly some harmonic resonance undulations of C^2TF, then such movements could be quite complex, including rotations (spins), to generate all the observed properties of elementary particles. Of course, the detailed roster of observed properties of elementary particles, including various conservation laws should be able to guide one to formulate the necessary complex undulations. Further, electrons must be more macroscopically *malleable* undulations (relatively speaking) in their physical shape and size compared to protons and neutrons. Visualize how 92 electrons are accommodated around a ^{92}U nucleus, making it about 0.1 nanometer size, while the nucleus is about

1femtometer size! Then consider how the conduction-band electrons behave differently than those in the valence band and how their movement becomes completely without resistance (viscosity-free fluid flow!) when the host medium becomes superconductive. Or, visualize how an electron keeps moving around a double-bond Benzene ring to provide extra stability to the molecule! In other words, we recognize that the proposed C^2TF model is only in its infancy! However, we should underscore that orderly and unique and resonant undulation for each particle is at the foundation of the origin of the material world. They cannot be generated by superposition of finite packets of propagating waves. Statistical origin of QM lies with the probabilistic life times of all quantum mechanical transitions, which are randomly influenced by the presence of innumerable other particles and waves cris-crossing every region of the universe all the time [14].

5. SUPERPOSITION EFFECT AS SELF-INTERFERENCE OF A PARTICLE IS NON-CAUSAL

Let us now make another generalized assertion and then justify it. Self-interference cannot be displayed by an *indivisible* particle. Our logic is based upon the Interaction Process Mapping Epistemology (IPM-E) [15]. First, a stable particle cannot influence its own motion by boot-strapping its own potential gradient around itself due to its own existential undulations. Second, the superposition effect becomes manifest, as successfully modeled by mathematics, when more than one similarly prepared entity ψ_n brings different phase information ϕ_n on the same detecting entity. $\Psi^*\Psi$ represents the possible energy that is deliverable to the detector for it to undergo physical transformation. Then we detect the transformation experienced by the detecting entity as the desired superposition effect. Of course, the energy exchange is possible only when the interaction between the detecting entity and the superposed entities are facilitated by a common interaction function ζ, which is an allowed amplitude-amplitude stimulation transfer function:

$$\Psi^*\Psi = \left|\sum_n \zeta_n \psi_n e^{i\phi_n}\right|^2 = \zeta^2 \left|\sum_n \psi_n e^{i\phi_n}\right|^2 \tag{13}$$

If ζ is a constant for the detecting entity for all the stimulating fields ψ_n's, it can be taken out of the square-modulus sign and treated as a *mere* detector constant; but we throw away the most important part of doing physics – understanding and visualizing the interaction processes that generates the observables! When we focus only on the quantities inside the square modulus sign (last step above), one can hypothesize superposition effects as self-interference. But self-interference would require that all the 2n phase and amplitude information, ψ_n and ϕ_n, could be carried by the same entity as a *multi-valued object*, which is a contradiction by our mathematical definition of a specific single entity at a particular space and time location. $\psi_n e^{i\phi_n}$ must represent, similarly prepared but independent entities for different n's. Besides, in QM, the final observables are always the ensemble averages $< \Psi^*\Psi >$.

It is important to note that the detector's stimulation is linear, but the energy transfer is non-linear and quadratic. Whenever the resultant linear stimulation $\sum_n \zeta \psi_n e^{i\phi_n}$ experienced by the detector is zero due to the sum of all the complex amplitudes, the detector cannot be excited and hence cannot register any measurable transformation and the location appears as a *dark fringe*. This is not the same logic as the *non-arrival of a particle* at this location. The concept, *non-arrival of a particle,* is not compatible with interaction process mapping epistemology (IPM-E). For in-phase condition, the stimulation is strong; the energy transfer is strong and the registered transformation under ensemble average is also strong, which we tend to call a *bright fringe*. *Bright fringe* is not due to arrival of all (or most) of the particles only at these locations.

One of the easiest ways to validate our model is to assume that particles do arrive at the dark fringe locations, but without inducing changes in the detecting molecules. So, we need to devise an experiment where these particles in dark fringe locations can be absorbed mechanically and then observe them by later stimulations. Suppose we use a mono-energetic beam of some alkali atoms for a multi-slit diffraction experiment. Let the detector be a layer of suitable detecting molecules deposited on a thick neutral emulsion of some organic material that does not undergo transformation due to impingement of alkali atoms being used. But this emulsion is capable of trapping all the alkali atoms passed through the thin detecting layer. It is a critical condition that the detection layer must be thick enough to register diffraction fringes, but thin enough to allow all the atoms disperse forward into the thick substrate emulsion and get stopped fully. If properly done, bright and dark fringes will be observed on the top detecting layer. If the emulsion is now back-illuminated at an angle by an appropriate resonant laser beam for the chosen alkali atoms, the emulsion will then emit resonant spontaneous emissions. Registered enlarged image of the emulsion using the spontaneous emission will appear almost uniform, without the multi-slit diffraction pattern, which is already registered on the front surface. If our

proposed hypothesis of the absence of self-interference in nature is incorrect, then the image by the spontaneous emission should also reproduce the multi-slit diffraction pattern, with no florescence coming from the dark-fringe locations.

de Broglie wave: Our model requires further comments regarding de Broglie wave associated with particles, which actually stimulated Schrodinger to formulate the *Wave Mechanics*. de Broglie's hypothesis,

$$\lambda = h / m\mathrm{v} \tag{14}$$

generates a divergence at v=0, which raises the question of causality if it is to be a correct and generalized principle of nature. However, Schrodinger's wave equation generates a time dependent component for a free particle. It does not represent a plain wave. Particles are localized. It is a real and physical internal harmonic undulation which also provides the stimulating phase when it interacts with another particle (see ϕ_n of Eq.13) [8,16]:

$$\psi(t) = e^{iEt/\hbar} = e^{i2\pi ft};\ \text{where } E = hf. \tag{15}$$

The success of Schrodinger equation then implies that all particles have various internal harmonic undulations, one of which is represented by its kinetic energy:

$$E = hf = (1/2)m\mathrm{v}^2 \tag{16}$$

We have now established that the prevailing belief of self-interference is incorrect for both EM waves and particles. Hence, we can abandon the hypothesis of wave-particle duality, and still maintain the current mathematical framework of QM. We do not need any *hidden variables* to bring causality back and eliminate wave-particle duality. The *wave-particle duality* has been causing enormous confusion to the enquiring minds of the beginning physics students. Besides, this duality hypothesis has also been a *feeding-frenzy* to philosophers from many different fields in asserting mystifying qualities to nature in the name of Physics! The reality is that we still have a long way to go and we still are quite ignorant about the interaction processes incessantly going on in nature in every macro and nano corners of the universe.

6. IF C^2TF MAY HAVE A BUILT-IN WEAK DISSIPATIVE PROPERTY TOWARDS PROPAGATING ELECTROMAGNETIC WAVES

We have proposed that the four known forces are four different secondary potential gradients created by the individual and/or assembly of stable resonant undulations of the C^2TF. If this turns out to be correct, then the non-linear decaying extensions of these force gradients across the entire cosmic space due to billions of galaxies may impose a slow dissipation of energy on the propagating EM waves, causing slow reduction in its frequency with distance. This, on the proposed face value, certainly appears to be a proposal like *tired light* [17]. However, there is a fundamental difference. This is not scattering of EM wave energy by material particles. This is as if the C^2TF has acquired a built-in dissipative property towards EM waves and functions as a slow sink of EM wave energy, perhaps, due to cumulative effect of diverse weak non-linear secondary potential gradients imposed on it by all the particles of the universe. Thus, the hypothesis of dissipative C^2TF would decrease the frequency of EM waves very slowly with the distance of propagation. This would eliminate the need for the hypothesis of *expanding universe*. Let us modify the standard finite-size propagating EM wave packet, as in Eq.17, into Eq.18 where α denotes the linear time (distance) dependent frequency reduction factor:

$$E(z,t) = a(t)\exp ik[z \pm ct] = a(t)\exp i[2\pi\nu\{(z/c) \pm t\}] \tag{17}$$

$$E(z,t) = a(t)\exp i[2\pi(\nu_0 - \alpha t)\{(z/c) \pm t\}] \tag{18}$$

The modified red-shifted frequency of the light arriving on the Earth from a galaxy at a distance D from the Earth will take a time interval $\tau = D/c$. Then the Eq.18 can be re-written as:

$$E_{Galx.\ to\ Erth}(z,t,\tau) = a(t)\exp i2\pi(\nu_0 - \alpha\tau)[(z/c) \pm t] \tag{19}$$

Using the Hubble and Doppler rules (Eq.20), we can extract a relation for our α in terms of the Hubble constant and the original frequency of the emitted wave, given in Eq.21:

$$\mathrm{v} = H_0 D \text{ (Hubble's Rule)};\quad \mathrm{v} = c\delta\nu/\nu_0 \text{ (Doppler's Rule)} \tag{20}$$

$$\begin{aligned} \mathrm{v} &= H_0 D = c\delta\nu/\nu_0 = c\alpha\tau/\nu_0 = \alpha D/\nu_0 \\ \text{Or, our}\quad \alpha &= H_0\nu_0 \approx (2.5\text{x}10^{-18}\text{sec}^{-1})\nu_0 \end{aligned} \tag{21}$$

This formulation is a pure *back-calculation* using measurable data modeling epistemology. It replaced one hypothesis by another just to keep the observed data unchanged. One still needs to explore whether this hypothesis can be verified

through some other experiments by tracing the changes necessary to enforce on Maxwell's wave equation. Future work will carry out such exploration. However, the value of this hypothesis of dissipative C^2TF lies in the fact that we have made many other hypotheses for the usefulness of C^2TF allowing us to think of a bottom-up unified field theory based on C^2TF.

7. CONCLUSIONS

The observable universe is built out of EM waves and elementary particles (and their assemblies). We have proposed that these are various kinds of undulations of a universal Complex Cosmic Tension Field (C^2TF). The proposed hypothesis is logically congruent with the observed property of EM waves. We have then extended the hypothesis to accommodate particles as resonant undulation of the same tension field. Then we have presented a series of logically congruent hypotheses to explain a large number of observed phenomena to strengthen the value of C^2TF. We believe that the hypothesis C^2TF as the universal field should be taken seriously by experimentalists and theoreticians since it could provide the foundation for a unified field theory. In summary:

1. We have argued that perpetually propagating photon *wave packets* moving with the extreme velocity "c", requires a sustaining complex cosmic *tension field* (C^2TF).

2. We have shown that *Ether Drag* related interferometric experiments cannot resolve the issue of existence or non-existence of ether. All such *null* and *positive* experiments conform to the concept that C^2TF is being dragged around by the earth.

3. We have proposed that if C^2TF has a built-in weak *dissipative property* towards electromagnetic waves, its frequency should decrease slowly with the distance of propagation through the C^2TF, which would eliminate the need for the hypothesis of *expanding universe*. This hypothesis also implies that C^2TF is a slow sink of propagating EM energy, generated through quantum transitions in atoms and molecules.

4. The reality of C^2TF would require that *stable particles* are *complex 3D resonant oscillations* of the C^2TF, which eliminates the *matter-ether dichotomy* and the *wave-particle duality*. We have proposed a specific experiment to validate this last assertion.

5. de Broglie wave hypothesis is replaced by one of the various complex internal undulations of particles proportional to their kinetic energy, further strengthening the rejection of *wave-particle duality*.

6. C^2TF holds the total energy of the universe. Most likely, there is no dark energy or dark matter. Manifest universe consist of propagating undulations (EM waves) and localized non-linear resonant undulations (particles) of this field.

7. The undulating particles create various kinds of gradients (curvatures!) around themselves, generating what we call various forces, which they use on each other to make themselves *fall* on each other and transform each other while making the manifest universe as a perpetually and dynamically evolving marvelous system, worth studying and enjoying!

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