A universal Complex Tension Field (CTF) as the substrate for the observable universe

1. **Organizational Information:**

Company name: Femto Macro Continuum (FMC)
Founder: Chandrasekhar Roychoudhuri, PhD
Email: croychoudhri@earthlink.net
Phone (cell): 860-465-6259.
Employer Identification Number: 45-2521316 (date of registration 06-13-2011)
The company FMC is a single person registered company and I will be happy to work under any non-profit organization as a consultant.

2. **Technology R&D Area: A universal Complex Tension Field CTF) as the substrate for our observable universe**

The core concept behind several proposed space based experiments is that the space itself is a real physical field, a Complex Tension Field (CTF)[1,2] [references are at the end of this Section 2], which is the cosmic inertial reference frame and also supports the existence of propagating EM signals as perpetually propagating waves; while the particles as localized resonant doughnut-like self-looped oscillations of the same CTF. The four forces are four different kinds of potential gradients produced by the different kinds of localized "particle" oscillations of the CTF. Thus, CTF becomes the foundational platform to support the emergence of a unified field theory that Einstein had dreamt for. I am proposing several space based experiments[3] that can validate the cosmic reality of CTF before funding other fields of fundamental physics is exhausted by NSF, DARPA and other DoD organizations. The strength of the CTF-postulate resolves a good number of prevailing self-contradictory postulates in classical optics, quantum optics, quantum mechanics and astrophysics, while opening up several new potential experiments that can validate the reality of CTF[3,4].

In the field of optics and quantum optics, I have carried out a good number of experiments[4] to validate that EM waves, being a linear excitation of the CTF everywhere, cannot interact with each other; they just cross-propagate or co-propagate through each other without altering the energy distribution of each other. I have called this property, Non-Interaction of Waves (NIW)[4]. This NIW property is also validated by the fact that we have been measuring most of the astrophysical properties of stars and galaxies by analyzing the unperturbed light beams from these diverse sources, which have crossed through innumerable other light beams emanated from other stars and galaxies.

CTF is really a more modified and a more descriptive phrase replacing old ether envisioned by many based upon the standing successes of Maxwell's wave equation, $c^2 = (\varepsilon_0^{-1} / \mu_0)$, which clearly implies that there has to be a cosmic space-wide tension filed possessing the properties ε_0^{-1} as the electric tension and μ_0 as the magnetic restoration tension. This modified Maxwell's relation is very similar to that for waves in a stretched mechanical string $\mathrm{v}^2 = (T / \sigma)$. Within the linear domain, mechanical string waves also pass through each other unperturbed to generate resonant musical tones in a string bounded in both ends, as in a guitar. The NIW-property is a universal phenomenon that we have been neglecting to explicitly recognize at the cost of accepting confusing postulates like wave-particle duality as the final reality of our universe[4]. The ether concept was dropped because it was supposed to support only EM waves; the particles (material world) belonged to a different phenomenon. This dichotomy became untenable. So, I have proposed[4] that both EM waves and the particles are different kinds of excited states of the same fundamental universal substrate that holds this common CTF.

The postulate of CTF as the cosmic inertial frame at rest automatically accepts the postulate of Special Relativity that the laws of physics (classical and quantum) are same in all stars and galaxies. The postulate of "constancy of c" everywhere is also accommodated by the CTF, with the caveat that in a moving medium it suffers a Fresnel drag.

However, these re-interpretations of the postulates of Relativity has profound consequences on the interpretations of the experiments related to (i) optical Doppler Effect (cosmology), (ii)) Michelson-

Morley (ether drag) and (iii) Fizeau (Fresnel drag). Accordingly, we are proposing three space based experiments to validate the postulate that the cosmic space is a stationary Complex Tension Field.

(i) ***Cosmological Redshift is a distance dependent propagation phenomenon; not a Doppler effect[5]:***

If light is a linear sinusoidal harmonic undulation of a tension field (CTF), like sound wave is that of the pressure tension field, then the optical Doppler effect must show separate dependence on the velocity of source (actual frequency shift) and that of the detector (apparent frequency shift), very similar to that displayed by sound waves in air tension field. Since the light emitting atoms and molecules within the stars never experience relativistic high velocity, we do not need to invoke Special Relativity to calculate the Doppler shift of the spectral lines emitted from within stars. In fact, the temperatures of stars' corona are determined by the Maxwell-Doppler spectral line broadening due to thermal velocity distribution of the atoms and molecules in the stars' corona. This concept has serious implication in interpreting the Cosmological Redshift; which must be a propagation phenomenon after the white light has emerged out of the star carrying the dark spectral absorption lines.

Use Null-Doppler shift spectrometry to determine the absolute vectorial velocity of stars with respect to the stationary CTF

Eq.1 is a modified copy of acoustic Doppler shift when both the source and the detector are moving. The subscripts and superscripts indicate velocity and frequency parameters. ${}^{nm}_{QM}\nu$ signifies the intrinsic quantum emission frequency by an atom or a molecule; which we assume to be same on the earth and in the corona of the stars. When a detecting spectrometer is given the identical vectorial velocity as that of the source, $\vec{v}_{\text{det.}} = \vec{v}_{src.}$; it will register the true source frequency:

$$ {}_{\text{det.}\pm}\nu = {}_{med.}\nu(1 \pm v_{\text{det.}}/c) = {}^{nm}_{QM}\nu \frac{(1 \pm v_{\text{det.}}/c)}{(1 \mp v_{src.}/c)} = {}^{nm}_{QM}\nu; \quad \text{for } \vec{v}_{\text{det.}} = \vec{v}_{src.} \tag{1} $$

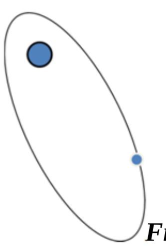

Figure 1. *A satellite in a steeply elliptical orbit around the Sun will provide a broad range of velocities to match up with other stars*

Thus, a well calibrated spectrometer set on a satellite in a steeply elliptical orbit (wide range of velocities) should be able to identify the velocity of some nearby stars at some specific location in its orbit. It is assumed that the spectrometer telescope is directed at the target star. This concept can be appreciated from the fact that stimulated emission in gas laser atoms happen only for those sets of spontaneously emitting and stimulated emitting atoms that happen to have identical vectorial velocity.

(ii) One-way light pulse arrival due to drag of source-detector assembly through the stationary CTF[3]:

On the earth based laboratories, all of our interferometry experiments using translating (moving) mirrors and pulsed light are successful based upon the assumption that the light pulses are trapped in the relatively stationary medium, air, in which the interferometers are immersed. Movement of one of the mirrors in any two-beam interferometry cannot determine diverse velocities of the earth itself (axial spin, orbital movement, Sun's movement in the Milky Way and the movement of the Milky Way). So, we are proposing a satellite based experiment where the arrival of the location of a light pulse on a spatially calibrated detector array from a pico second pulsed laser fixed on the same frame, but a couple meters away, will be determined by the "drag" of the satellite against the stationary CTF in space. This is to distinguish from the presence of stationary air within the interferometer on earth. Different orientation of the satellite (and hence that of the set up) will give us different velocities with respect to the stationary CTF. ***We believe that the use of CW light source in interferometry creates many conceptual and computational problems[1]while considering relativistic phenomenon.***

We need to measure the real velocity of light. M-M experiment tries to measure relative phase difference; not the real velocity!

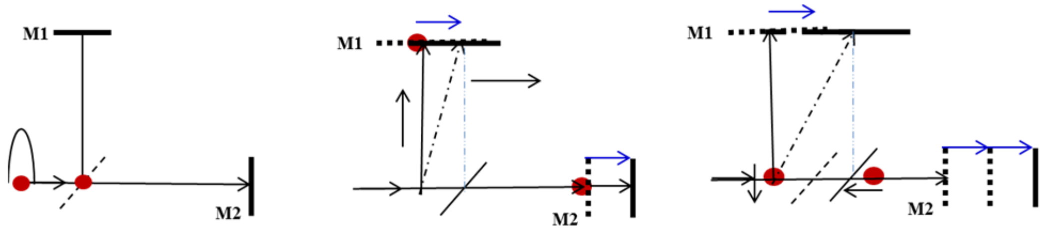

Figure 2: *Computation of relative path delays using CW light crates confusion. Light beams travel along the Poynting vector, not a tilted path along with a moving interferometer. If the interferometer is immersed within a medium like air or water, then the interferometer appears stationary to the light beams.*

A short pulse of light illustrates the point (Fig.2). The M-M interferometer is immersed in stationary air and stationary CTF. Light travel direction is completely controlled by the Poynting vector on the wave front, not by the direction of the movement of the interferometer. So, the pulse on its vertical journey, on arrival, may just get reflected from the edge of the top mirror. On its return, it may not even encounter the beam splitter, if the interferometer vertical arm-length is made very very long! Light does not travel along lengthened triangular paths in M-M interferometer as are depicted in all papers and books. The top mirror may translate laterally; but the light travels straight vertically up and down; except for suffering transverse Fresnel Drag if the M-M interferometer moves with respect to the air. This transverse Fresnel Drag is positive, but negligible. No ***interferometry*** experiment can un-ambiguously discern the "ether problem" either in air or in the vacuum. Calculation of the relative path delay using the tilted "ray" for the vertical journey and back, does not correspond to the path taken by the Poynting vector on the wave front. This is why we are proposing the position (velocity) measurement for the arrival of a light pulse in a one-way travelling set up.

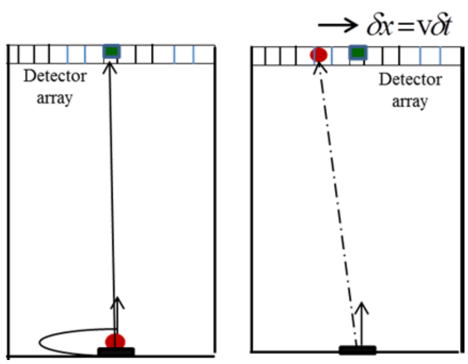

Figure 3. *A position-calibrated detector array is mounted on a light and rigid structure. It is a couple of meters far from a pico second pulsed diode laser.*

We are proposing that a calibrated detector array be mounted on a rigid and light structure with a meter or two distance from a pico second pulsed diode laser. Under the assumption that CTF is always and everywhere stationary, if the above setup in a satellite moves laterally, the arrival spot on the detector array for the light pulse will be to the left or right of the central spot. When the beam propagation axis is aligned with the velocity vector (positive or negative) of the satellite, the arrival time of the light pulse will be different for positive or negative vectorial alignment. To discern these time delays, one has to create a more complex long-path system (to be considered in future).

(iii) Positive and null Fresnel Drag in space due to the drag of material against the stationary CTF[2]:

Positive Fresnel drag has been first quantitatively validated by Fizeau by using a two-way circulating light propagating interferometer containing running water through tubes. The null Fresnel drag has also been demonstrated by my group[2] using a Mach-Zehnder interferometer containing stationary transparent medium in one arm but without using two-way circulating beam. Our postulate is that only a moving material medium can drag light as it is an undulatory phenomenon of the stationary CTF. We are proposing that we use two Mach-Zehnder interferometers (MZ) on a satellite as shown in Fig.4. One of the MZs will have a moving fluid; the other one will have a stationary medium. We predict that only the moving-fluid MZ will give positive Fresnel drag. Space-worthy design will be carried out when funded.

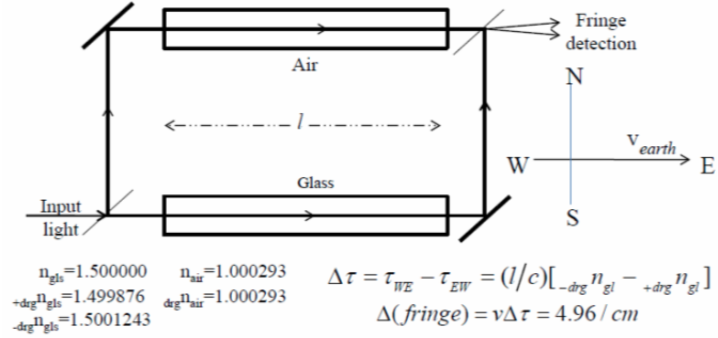

Figure 4: *Null Fresnel drag measured on earth using this Mach-Zehnder interferometer with a stationary glass block in one arm and air in the other. In Fizeau's positive drag measurement, he used a two-way circulating light beams through moving water in both the arms.*

REFERENCES:

1. *C. Roychoudhuri, "Next frontier in physics – space as a complex tension field", J. Mod. Phys., Volume 3, Number 10 (October 2012).*
2. *C. Roychoudhuri, M. Barootkoob, & M. Ambroselli, "The constancy of "c" everywhere requires the cosmic space to be a stationary and complex tension field"; SPIE Proc. Vol. 8121, paper #23 (2011).*
3. *C. Roychoudhuri and M. Ambroselli, "Could space be considered as the inertial rest frame?"; Proc. SPIE Vol. 9570, paper # 30 (2015).*
4. *C. Roychoudhuri, Book: Causal Physics: Photon Model by Non-Interaction of Waves, Taylor and Francis, 2014.*
5. *C. Roychoudhuri, "Tribute to H. John Caulfield: Hijacking of the 'holographicprinciple' by cosmologists," Proc. SPIE 8833-15 (2013).*