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Alternative Explanation of the Cosmological Red Shift by the Tachyon Plasma Field in Intergalactic Space

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Abstract- From the assumption that intergalactic space is filled with tachyon plasma, it can be shown that the cosmological redshift can be explained by electromagnetic attenuation in the tachyon plasma field. According to this model, the photon propagates in a superluminal speed between intergalactic space.

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I. Introduction

The author proposed the model to explain the riddle of the rotational speed of the galaxy by using the tachyon field instead of dark matter because the tachyon repels with the ordinary matter [1]. According to this model, the cosmic space is filled with tachyons. By using this model, the author proposes an alternative cosmology instead of the conventional theory.

The current interpretation of observed redshift of light from distant galaxies is due to the expansion of the universe. Contrary to this interpretation, alternative explanations for the cosmological redshift were proposed by some researchers [2-4]. The tired light effect was proposed by Fritz Zwicky in 1929 as a possible alternative explanation for the observed cosmological redshift. The basic proposal amounted to light losing energy due to the distance it traveled rather than any metric expansion or physical recession of sources from observers. Other proposals for explaining how photons could lose energy included the scattering of light by intervening material in a process similar to observed interstellar reddening. However, all these processes would also tend to blur images of distant objects, and no such blurring has been detected. The author has shown that the gravitational field due to the zero-point fluctuation (ZPF) field can be cancelled by the tachyon field created out of the ZPF background and almost of all energy of the cosmic background radiation is due to the Cherenkov radiation from tachyons created from the ZPF field [5,6]. Contrary to their explanations for the cosmological redshift, the author also proposes the alternative mechanism of propagation of light and he presents that the cosmological redshift can be explained from the assumption that intergalactic space is filled with virtual tachyon plasma created from the ZPF field.

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II. Tachyon Field Generated From The ZPF Background

From the wave equation for the moving elementary particle shown as

$$i\hbar\frac{\partial\psi}{\partial t}=\sqrt{p^2c^2+m_0^2c^4}\,\psi\,, \tag{1}$$

which satisfies

$$\psi(x,t)=A\cdot\exp\left[-i\left(\frac{E}{\hbar}t-\frac{p}{\hbar}x\right)\right], \tag{2}$$

where ψ is wave function of the moving particle, c is a light speed, $\hbar$ is a Plank's constant divided by 2π, m_0 is a proper mass of the particle, E is energy of the particle and p is its momentum.

By using the proper acceleration given by $p=m_0\alpha t$, Eq.(1) can be rewritten as

$$\frac{\partial\psi}{\partial p}=-\frac{i}{m_0\alpha\hbar}\sqrt{p^2c^2+m_0^2c^4}\,\psi \tag{3}$$

According to the theory of quantum mechanics, the empty space is filled with virtual particles, most of which are low energy photons moving in an evanescent mode.

Supposing that the virtual photon created from ZPF field is accelerated to the light speed inside the quantum region with the size of the Plank length l_p, we have $\alpha=c^2/l_p$ from the uncertainty principle and $m_0=\hbar\omega/c^2$, where ω is an angular frequency of photons.

From which, the probability of the pair of a tachyon and an anti-tachyon created from ZPF vacuum by quantum tunneling effect can be estimated by [7]

$$T\approx\exp\left[-\gamma\, l_p\omega\right] \tag{4}$$

where

$$\gamma = -\frac{3\log 3 - 2 + 3\log(\hbar / c)}{\sqrt{3}c} \approx 5.62 \times 10^{-7}, \quad (5)$$

By quantum electrodynamics, spectral energy density of ZPF field in vacuum is given by [8]

$$\rho(\omega)d\omega = \frac{\hbar\omega^3}{2\pi^2 c^3} d\omega \ , \quad (6)$$

The mass of virtual photon created inside the quantum region with the size of the Plank length yields the Plank mass m_p from the uncertainty principle shown $\Delta p \cdot l_p \approx \hbar$.

From Eqs. (4) and (6), number of virtual tachyons created from ZPF field per unit volume can be roughly estimated by

$$N \le \int_0^{\omega_c} \frac{\hbar\omega^3}{2\pi^2 m_p c^5} \exp\left[-\gamma\, l_p \omega\right] d\omega, \quad (7)$$

where ω_c is the cutoff frequency of ZPF field given by [8]

$$\omega_c = \left(\frac{\pi\, c^5}{\hbar G}\right)^{1/2}, \quad (8)$$

which has the order of the Plank frequency.

By the numerical equation, we have $N \le 8.8 \times 10^{94}$ per unit volume from Eq.(7) and hence it can be considered that the empty space is filled with pairs of positive and negative charged virtual tachyons created from ZPF vacuum if the tachyon has an electric charge.

III. Electromagnetic Wave Traveling In a Tachyon Plasma Field

Supposing that the intergalactic space is filled with tachyon plasma created from ZPF field, electromagnetic waves below the plasma frequency are attenuated by scattering of particles inside plasma field given by [9]

$$mv = q\vec{E}\tau \quad (9)$$

where m is a mass of the particle, v is its velocity, q is its charge, $\vec{E}$ is an electric field and τ is the time interval between collisions.

From which, the resonant frequency of the tachyon plasma can be estimated by [9]

$$\omega_p = \sqrt{\frac{Nq^2}{m_t \varepsilon_0}} \quad (10)$$

where m_t is the mass of a tachyon given by

$$m_t = \frac{m_*}{\sqrt{v^2/c^2 - 1}} \quad (11)$$

in which, m_* is an absolute values of the tachyon's proper mass.

From the uncertainty principle for the tachyon given by [10]

$$\Delta p \cdot \Delta t \approx \frac{\hbar}{v - c}, \quad (12)$$

The velocity of the tachyon moving in an empty space can be roughly estimated as $v \approx 2c$ [6]. Then the mass of the tachyon becomes

$$m_t \approx \frac{\hbar}{c l_p}, \quad (13)$$

from the relations, $m_t \approx \Delta p / 2c$ and $\Delta t \approx l_p / 2c$.

We suppose that the charge of the tachyon almost equals to that of electrons[11], the resonant angular frequency of tachyon plasma field can be evaluated as $\omega_p \approx 1.08 \times 10^{38} (rad/s)$ at most from the value $N \approx 8.8 \times 10^{94} / m^3$.

IV. Alternative Mechanism for the Light Propagation through the Intergalactic Space

Consensus by cosmologists and astrophysicists strongly support that astronomical bodies and structures in the universe are mostly influenced by gravity, Einstein's theory of general relativity and quantum mechanics, to explain the origin, structure and evolution of the universe on cosmic scales. Presently, plasma cosmology is openly rejected by the vast majority of researchers because it does not match modern observations of astrophysical phenomena or accepted cosmological theory. However, from the standpoint of tachyon plasma field, alternative mechanism for the light propagation in the space can be proposed.

According to the electromagnetic theory, electromagnetic waves in the plasma can be described as

$$\frac{\partial^2 \vec{E}}{\partial x^2} - \left(\frac{\omega_p}{u}\right)^2 \vec{E} = \frac{1}{u^2}\frac{\partial^2 \vec{E}}{\partial t^2}, \quad (14)$$

By substituting $E = A \cdot \exp[i(kx - \omega t)]$ into Eq.(14), we have

$$k = \pm i\sqrt{\omega_p^2 - \omega}\,/\,u \ , \tag{15}$$

As the electric field can be described by $\vec{E} = -\nabla\phi - \partial\vec{A}/\partial t$ by using the scalar potential ϕ and the vector potential $\vec{A}$, the wave equation for the electromagnetic field can be given by [12]

$$\nabla^2\phi - \frac{1}{u^2}\frac{\partial^2}{\partial t^2}\phi = -\frac{\rho}{\varepsilon_0} \ , \tag{16}$$

$$\nabla^2\vec{A} - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\vec{A} = -\mu_0\vec{J} + \left(\frac{1}{c^2} - \frac{1}{u^2}\right)\frac{\partial\nabla\phi}{\partial t} \ , \tag{17}$$

where ρ is a charge density, $\vec{J}$ is a current density, ε_0 and μ_0 are a permittivity and a permeability of free space.

For the case when satisfying $\omega_p >> \omega$, the vector potential, the velocity of which in a free space equals the light speed, is rapidly attenuated and finally becomes zero from Eq.(15) and only longitudinal waves scalar potential is much higher that the light speed.

$$\nabla^2\phi - \frac{1}{c_l^2}\frac{\partial^2}{\partial t^2}\phi = -\frac{\rho}{\varepsilon_0} \ , \tag{18}$$

$$\left(\frac{1}{c^2} - \frac{1}{c_l^2}\right)\frac{\partial\nabla\phi}{\partial t} = \mu_0\vec{J} \ , \tag{19}$$

where c_l is the velocity of longitudinal waves.

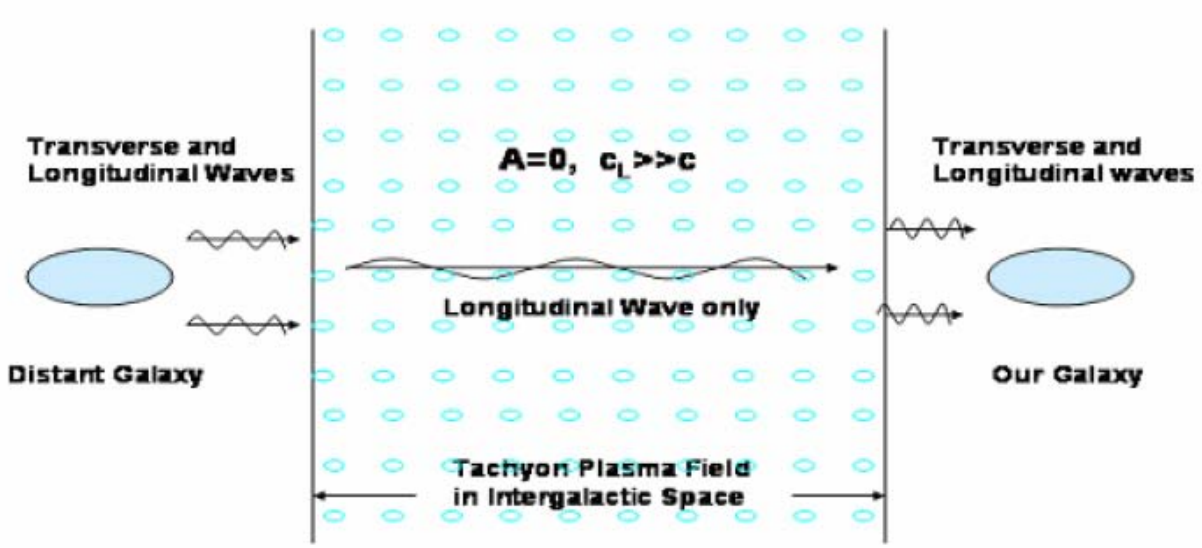

Figure 1: Wave propagation in the intergalactic space

Figure.1 shows the wave propagation in the intergalactic space, and transverse waves are attenuated inside tachyon plasma field between the intergalactic space and only longitudinal waves propagate through it and reach to our galaxy.

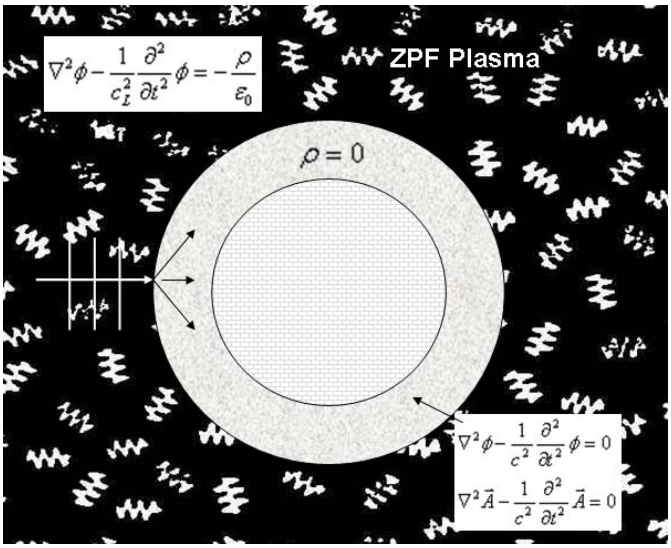

Figure 2: Transformation of mode of scalar waves into transverse and longitudinal waves

Supposing that there is no tachyon plasma field in the neighborhood of our planet as shown in Fig.2, where $c_l = c$, $\rho = 0$ and $\vec{J} = 0$, the scalar wave is transformed into transverse and longitudinal waves according to Eqs. (16) and (17), given by

$$\nabla^2\phi - \frac{1}{c_l^2}\frac{\partial^2}{\partial t^2}\phi = 0 \ , \qquad (20)$$

$$\nabla^2\vec{A} - \frac{1}{c^2}\frac{\partial^2}{\partial t^2}\vec{A} = 0 \ , \qquad (21)$$

From Eq.(15), we have $k \approx \pm i\omega_p / c_l$ for the photo traveling in a longitudinal mode inside the plasma field, which frequency is much lower than the plasma resonant frequency. Then the energy of the photon inside the plasma field is given by

$$E(x) = E_0 \exp(-\beta x) = E_0 \exp\left(-\frac{2\omega_p}{c_l}x\right), \qquad (22)$$

where E is the energy of the photon, β is an attenuation constant and x is a traveling distance of the photon from its source.

V. Red Shift of the Light From the Distant Galaxies due to Tachyon Plasma Field

A minority of astrophysicists has been unconvinced that the cosmological redshifts as shown in Fig.3 are associated with a universal cosmological expansion. Skepticism and alternative explanations began appearing in the scientific literature in the 1960s. In particular, G. Burbidge, W. Tifft and H. Arp were all observational astrophysicists who proposed that there were inconsistencies in the redshift observations of galaxies and quasars.

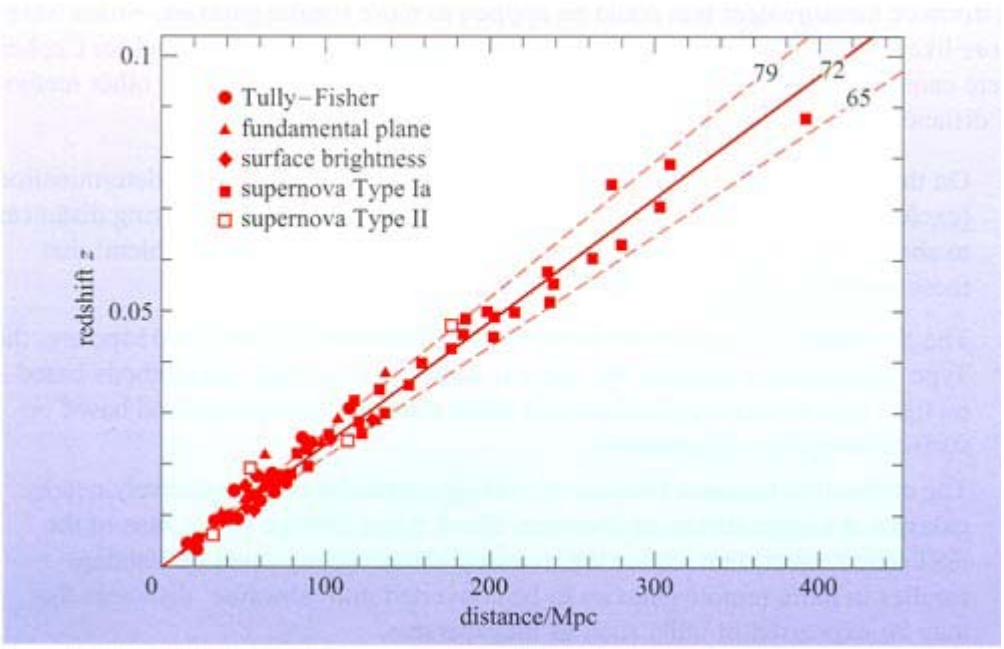

Figure 3: Cosmological redshift of distant astronomical bodies (www.astro.virginia.edu)

From the relation of energy of waves shown as $E = 2\pi\hbar c/\lambda$, the wavelength of the photon becomes

$$\lambda(x) = \lambda_0 \exp\left(\frac{2\omega_p}{c_l}x\right), \quad (23)$$

where λ_0 is the wavelength of the photon at the instant of emission and λ is the wavelength of the photon at the distance of x.

If the values of $2\omega_p/c_l$ is negligibly small compared with unity, the relation of the redshift of the photon at the distance of x can be given by

$$\frac{\lambda-\lambda_0}{\lambda_0} = \exp\left(\frac{2\omega_p}{c_l}x\right) - 1 \approx \frac{2\omega_p}{c_l}x, \quad (24)$$

From which, the receding velocity of distant galaxies can be obtained as

$$v/c = \frac{2\omega_p}{c_l}x, \quad (25)$$

where the speed of the longitudinal wave in an intergalactic space can be estimated from the Hubble constant H_0 as

$$c_l \approx \frac{2\omega_p c}{H_0} \le 3.24\times10^{64}(m/s), \quad (26)$$

from relation given by $v = H_0 x$ [13].

Considering higher terms of in Eq.(24), the velocity of expansion becomes

$$v/c = \frac{2\omega_p}{c_l}x + \frac{1}{2}\left(\frac{2\omega_p}{c_l}\right)^2 x^2 + \frac{1}{6}\left(\frac{2\omega_p}{c_l}\right)^3 x^3 + \cdots, \quad (27)$$

If we let $c_l = 3.24\times10^{64}(m/s)$, expanding velocity of galaxies can be calculated from Eqs.(25) and (27) respectively as shown in Fig.4 and Fig.5, where the horizontal line is for a distance in billion light years and the vertical line is for the receding speed divided by the light speed.

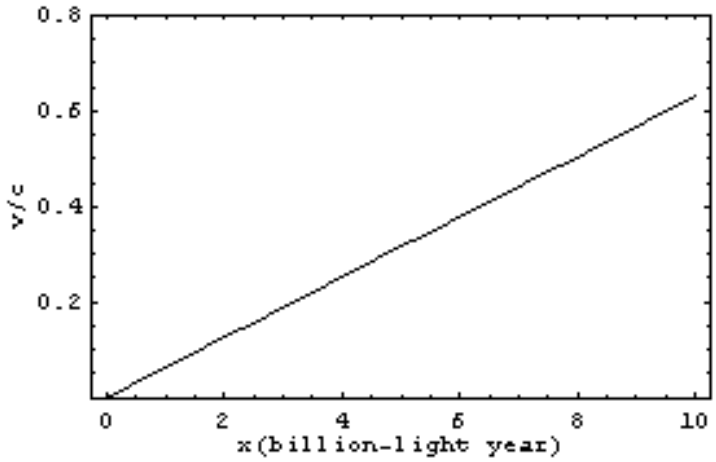

Figure 4: Speed of the distant galaxy predicted by Eq.(25)

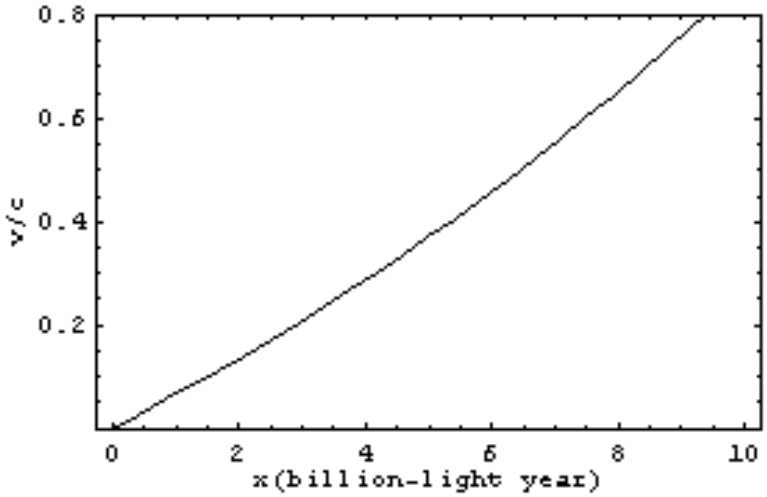

Figure 5: Speed of the distant galaxy predicted by Eq.(27)

From these figures, the calculation result considering higher terms shows that the receding speed of galaxies is accelerated with increased distance from us.

Recently astronomer groups have revealed the cosmic expansion is speeding up from the observation of very distant supernovae [14]. They concluded that their observation result is due to the repulsive cosmological constant, but it might also be explained by the attenuation of electromagnetic waves traveling in the intergalactic tachyon plasma field.

During the quasar controversies of the 1970s, these same astronomers were also of the opinion that quasars exhibited high redshifts not due to their incredible distance but rather due to unexplained intrinsic redshift mechanisms that would cause the periodicities and cast doubt on the Big Bang. If we suppose that the tachyon plasma field surrounding quasar is more dense due to the energy production mechanism than that of the intergalactic space, since the energy output required to explain the apparent brightness of cosmologically-distant quasars was far too high to be explainable by nuclear fusion alone, we can explain high redshift observed by the experiments.

This interpretation of the cosmological redshift is also compatible with the finding that redshifts increases with distance in discrete values, rather than in a continuous curve. Spectral studies indicated that cosmological redshifts are quantized [15-17], that cannot be explained by Doppler shift of the conventional theory.

In 1973, astronomer William G. Tifft was the first to report evidence of this pattern. Subsequent discourse focused upon whether redshift surveys of quasars have produced evidence of quantization in excess of what is expected due to selection effect or galactic clustering. The idea has been on the fringes of astronomy since the mid-1990s and is now discounted by the vast majority of astronomers, but a few scientists who espouse nonstandard cosmological models, including those who reject the Big Bang theory, have referred to evidence of redshift quantization as reason to reject conventional accounts of the origin and evolution of the universe. Instead of the conventional theory, observed quantized

represents discrete steps in the decay of photon energy by the propagation of photons through intergalactic plasma field.

VI. Conclusion

In this paper, it is shown that the cosmic redshift of light can be explained by the attenuation of electromagnetic waves in the intergalactic tachyon plasma field. From which, the recent observation result that cosmic expansion is speeding up can also be explained by the exponential attenuation of electromagnetic waves in the intergalactic tachyon plasma field.

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