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Instability of Space-time Continuum from the Standpoint of ZPF Field in a Vacuum

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

By applying quantum tunneling effect for photons generated from ZPF vacuum, it is considered that some of them can be generated as superluminal particle.

If they have electric charges, they radiated electromagnetic energy by the Cherenkov effect. This leads to another explanation of the origin of Cosmic Background Radiation, which is distributed uniformly over the space. From this standpoint, it can be shown that the upper limit of temperature can be existed at about 10^{14} Kelvins, which is too low compared with the estimation by String theory.

If temperature in the space including electromagnetic energy becomes more that this upper limit of temperature, the space-time continuum becomes instable because negative energy can be generated by tachyon field.

Keywords: Cherenkov effect; ZPF vacuum; tachyon; negative energy.

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1. INTRODUCTION

L. M. Caligiuri and T. Musha, has shown the possible existence of superluminal world beyond the light barrier within the framework of quantum physics in their book [1].

By theoretical and experimental results, hypothetical tachyons, astrophysical quasars, anomalous dispertion in material media, quantum tunneling of single photons and quantum entanglement, gave founded evidence of the occurrence of superluminal processes. From this theory, the author formally proposed in his paper that the cosmic background radiation (CBR) might be due to the Cherenkov radiation from faster-than-light photons created in a ZPF (zero point energy fluctuation) field in a vacuum [2]. The calculation result shows that the spectrum and the mass density of energy due to Chrenkov radiation almost coincides with the cosmic background radiation observed.

According to his equation for estimating Cherenkov radiation from the ZPF field, it can be seen that the radiation from the ZPF field is increased when the temperature of the vacuum is increased, which can induce instability of space-time around the extremely hot heat source which has a temperature of over one million times the temperature generated by nuclear explosion.

On November 1, 1952, the first hydrogen bomb by using Teller–Ulam configuration was tested at full scale in the "Ivy Mike" shot at an island in the Enewetak atoll, which had a yield of 10.4 megatons, that was about 3.5 times higher than expected by the theoretical calculation. The next advance was to use a solid lithium deuteride fusion fuel instead. In 1954, this was tested in the "Castle Bravo" shot (the device was code-named the Shrimp), which had a yield of 15 megatons, that was 2.5 times higher than expected [3]. From these experimental results, it can be suspected that the thermal nuclear radiation by the nuclear weapon might be enhanced by some unknown physical processes. From these observed results, it is considered that the large amount of electromagnetic energy by the nuclear weapon, which produces a high temperature in a surrounding space, wherein the temperature by the fission reaction attains about 300,000 Kelvins at the center of explosion and the temperature by the fusion nuclear explosion can go up into the million of Kelvins [4], can be enhanced by the Cherenkov radiation from the ZPF field in a vacuum and produced excessive amount of energy more than estimation by the theoretical calculation.

In this paper, the possibility that the thermal radiation from nuclear weapons can be greatly enhanced by the Cherenkov radiation from the ZPF field is discussed, which also leads to the instability of a space-time continuum. This reveals that there was no Big Bang by the instability of space-time continuum.

2. POSSIBILITY OF PHOTONS GENERATED FROM ZPF VACUUM IN A SUPERLUMINAL STATE

From the Klein-Gordon equation given by

$$i\hbar \frac{\partial \psi}{\partial t} = H\psi , \tag{1}$$

where $H = \sqrt{p^2c^2 + M^2c^4}$ (p : momentum of the particle, M : effective mass of the particle, c : light speed), ψ is wave function of the tunneling photon, and $\hbar$ is a Plank's constant divided by 2π , the following equation for the accelerated particle can be obtained as [5];

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

where α is the proper acceleration.

If the photon is generated in a quantum region, which size is l, the proper acceleration of the photon becomes $\alpha = \Delta p/(m\Delta t) \approx c^2/l$ from the uncertainty principle given by $\Delta p \cdot l \approx \hbar$, and formulas $\Delta E = \Delta p \cdot c$, $\Delta E = mc^2$ and $\Delta t = l/c$.

Then the wave equation for both cases, those are subluminal and superluminal, can be given by

($v < c$)

$$\psi = C \cdot \exp\left[-i\frac{\omega}{2c} l\sqrt{1-\beta^2}\left(\frac{\beta}{1-\beta^2} + \log(\hbar\omega/c) + \log(1+\beta) \right) \right] , \tag{3.1}$$

($v > c$)

$$\psi^* = C \cdot \exp\left[-\frac{\omega}{2c} l \sqrt{\beta^2 - 1} \left(\frac{\beta}{\beta^2 - 1} - \log(\hbar\omega / c) - \log(1 + \beta) \right) \right] . \qquad (3.2)$$

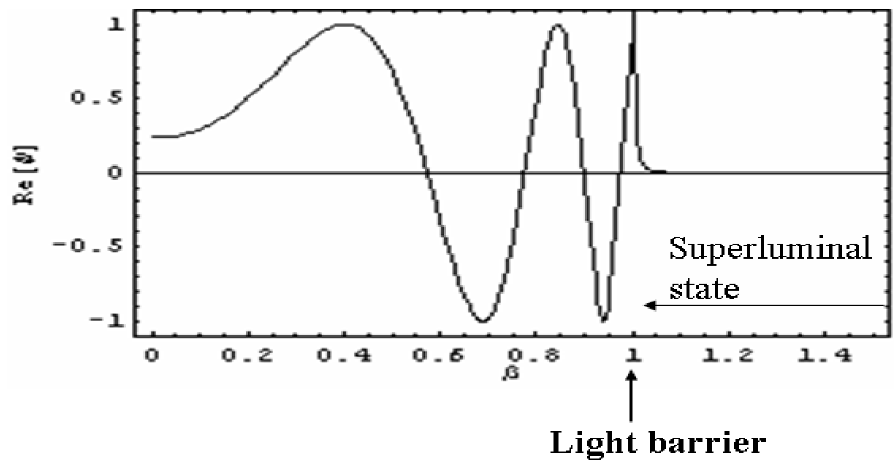

Fig. 1. Wave function beyond the light barrier by tunneling effect

From which, it can be seen that the wave function of a photon exists beyond the light barrier as shown in Fig. 1 and there is a possibility that a virtual superluminal particle can be created from a ZPF field.

According to the WKB approximation, the penetration probability through the light barrier of the tunneling photon can be roughly estimated as

$$T_p \approx |\psi_*|^2 / |\psi|^2 = \exp\left[-\frac{\omega}{c} l \sqrt{\beta^2 - 1} \left(\frac{\beta}{\beta^2 - 1} - \log(\hbar\omega / c) - \log(1 + \beta) \right) \right] . \qquad (4)$$

From the uncertainty principle, we have $\beta \approx 2$, and Eq.(4) can be approximated as [5];

$$T_p \approx \exp(-\gamma \cdot l_p \omega) , \qquad (5)$$

Where

$$\gamma = \frac{3\log 3 - 2 + 3\log(\hbar / c)}{\sqrt{3}c} \approx 5.62 \times 10^{-7} \qquad (6)$$

In empty space, virtual particles, most of which are low energy photons, are created out of the ZPF background. From E.(5), it can be concluded that some of virtual particles created from ZPF field can be permitted to be generated in a superluminal state within a finite length of time according to the uncertainty principle.

3. CHERENKOV RADIATION FROM SUPERLUMINAL PHOTONS AT HIGH TEMPERATUES

From the Rayleigh-Jeans radiation law, the energy density of electromagnetic radiation below the angular frequency ω_0 becomes [6]

$$\rho_E = k_B T \int_0^{\omega_0} \frac{\omega^2}{\pi^2 c^3} d\omega = 8\pi k_B T \int_{\lambda_0}^{\infty} \frac{d\lambda}{\lambda^4} = \frac{8\pi k_B}{3} \frac{T}{\lambda_0^3} \qquad (7)$$

where k_B is a Boltzman constant, T is a temperature and λ_0 is a wavelength of a cut-off frequency.

If superluminal particles (we may call it tachyon according to Finberg) created from the ZPF vacuum have an electric charge, it radiates photons at the angle of $\theta_c = \cos^{-1}(1/\beta n)$, where θ_c is half-angle of the Chrenkov radiation from the particle moving at the speed of $\beta = v_* / c$ and n is the index of refraction, which equals to unity in a vacuum, because Cherenkov radiation allows the decay $T \rightarrow T + \gamma$, where T represents a tachyon.

Thus electromagneric radiation can be produced by the Cherenkov effect from tachyon pairs created from the ZPF vacuum.

According to statistical electrodynamics (SED), small fraction of energy from electromagnetic field by the Cherenkov effect can be radiated as blackbody radiation, which yields [7];

$$\rho'_E(\omega) = \frac{\hbar\omega^3}{2\pi c^3} T_p(\omega) \frac{\sum_{k=0}^{\infty} k e^{-k\hbar\omega/k_B T}}{\sum_{k=0}^{\infty} e^{-k\hbar\omega/k_B T}} = \frac{\hbar\omega^3}{2\pi^2 c^3} \exp\left(-\frac{\gamma\, l_p}{c}\omega\right) \cdot \left[\exp\left(\frac{\hbar\omega}{k_B T}\right) - 1\right]^{-1}. \tag{8}$$

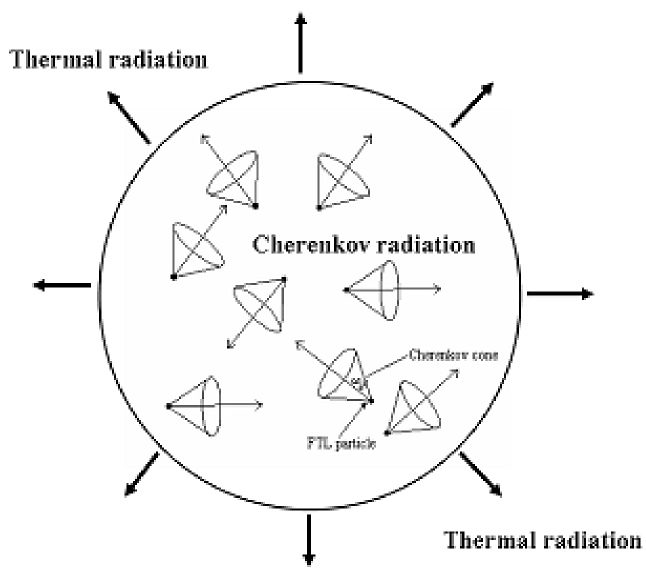

Fig. 2. Cherenkov radiation from tachyon pairs particles created from the ZPF vacuum

Then the energy density radiated by the Cherenkov effect from the ZPF field at the temperature of T becomes

$$\begin{aligned}
\rho'_E &= \frac{\hbar}{\pi^2 c^3} \int_0^{\omega_0} \omega^3 \exp\left(-\gamma \cdot l_p \omega\right) \left[\exp\left(\frac{\hbar\omega}{k_B T}\right) - 1\right]^{-1} d\omega \\
&= -16\pi^2 c\hbar \int_{\lambda_0}^{\infty} \lambda^{-5} \exp\left(-\frac{2\pi\gamma c\hbar}{\lambda}\right) \left[\exp\left(\frac{2\pi c\hbar}{k_B T\lambda}\right) - 1\right]^{-1} d\lambda \\
&= \frac{6k_B^4 T^4}{\pi^2 c^3 \hbar^3} \zeta(4, 1+\alpha) - 16\pi^2 c\hbar \int_0^{\lambda_0} \lambda^{-5} \exp\left(\frac{2\pi\gamma c\hbar}{\lambda}\right) \left[\exp\left(\frac{2\pi c\hbar}{k_B T\lambda}\right) - 1\right]^{-1} d\lambda
\end{aligned} \tag{9}$$

where $\alpha = k_B l_p \gamma T / \hbar$.

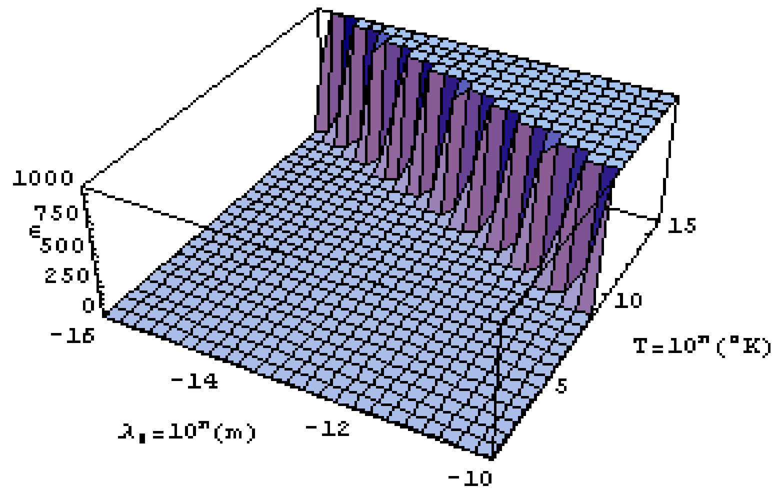

Fig. 3. Relation between the ratio of the total energy from heat source and Cherenkov radiation from tachyon pairs vs. the net radiated energy from heat source vs. the upper wavelength of radiation

From which, the ratio of total energy radiated from the heat source and Cherenkov radiation from tachyon pairs , which equals $\rho_E + \rho_E'$, versus the net radiated energy from heat source ρ_E becomes

$$\varepsilon = \frac{\rho_E + \rho_E'}{\rho_E} = 1 + \rho_E' / \rho_E . \qquad (10)$$

The calculation result of ε versun the wavelength of radiation is shown in Fig. 3.

4. QUANTUM INSTABILITY OF THE SPACE-TIME CONTINUUM CAUSED BY CHERENKOV RADIATION

From Fig. 3, the thermal radiation in a space including the heat source, the ratio ε of the total energy of heat source and Cherenkov radiation from tachyon pairs versus the net radiated energy from heat source is very small below the temperature at 10^{13} $\circ K$ (Kelvins) at the upper spectrum of gamma rays, but the temperature exceeds more than 10^{14} $\circ K$, it can be seen that the ratio ε of radiated energies is exponentially increased.

According to the principle of relativity, we have the following relation for observers moving with velocities of u and v respectively [8].

$$E' = \gamma(1 - uv/c^2)E \ , \qquad (11)$$

where E and E' are energies for observers moving with velocities of u and v , and the value of γ is a quantity which equals $(1 - u^2/c^2)^{-1/2}$.

When virtual tachyons lose their energies by the Cherenkov radiation, they are further accelerated to infinity speed and negative energy state for all observers may appear from Eq. (11). The occurrence of negative energy states for particles means that no other system could be stable against the emission of these negative energy particles and spontaneous vacuum explosion may take place [9], which leads to the instability of a space-time continuum.

Hence there is a possibility that the space-time continuum can be destroyed in the neighborhood of a space surrounding the center of thermal explosion if the ultra high temperature, which is over one million times the temperature by the hydrogen bomb, can be produced.

According to the string theory, the highest possible temperature can be given by $(Plank\ mass) \times c^2 / k_b \approx 10^{32}\ \circ K$ [10]. From which, the temperature of the new born Universe can be estimated as 10^{32} $\circ K$. But, from our calculation result, the space-time continuum might be collapsed at the temperature more than

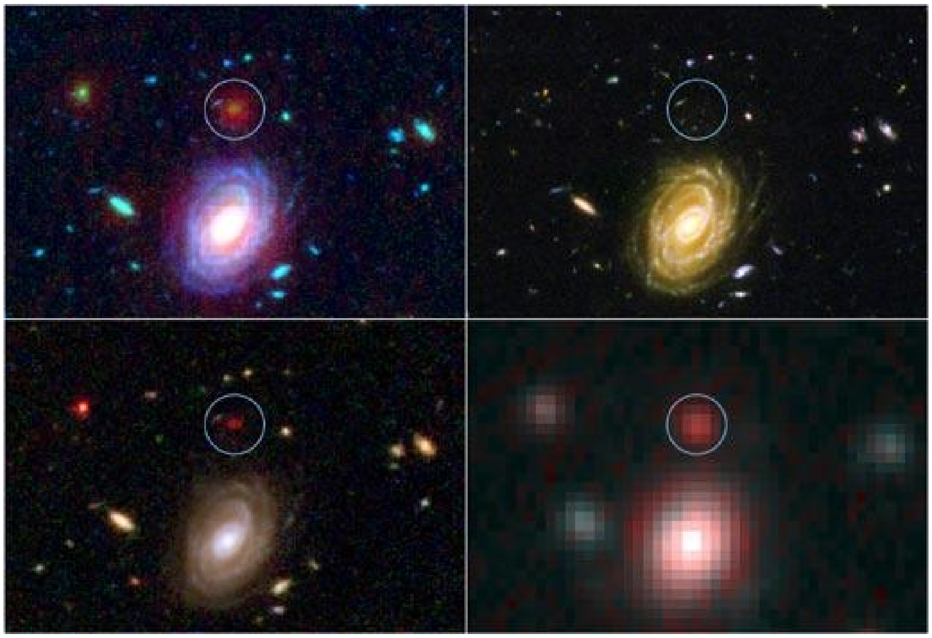

Fig. 4. Unusually massive and mature galaxy observed in the circle

10^{14} °K and the new born Universe could not be stable at that ultra high temperatures and it is concluded that the space-time continuum of the new born Universe might be collapsed immediately after creation. According to the present cosmology, our Universe was created at the ultra high temperature state by the Big Bang. However, according to our calculation result, we must reconsider the present cosmology and the Big Bang theory from the standpoint of ZPF vacuum.

From the observations by NASA's Great Observatories, the Spitzer and Hubble Space Telescopes, one of distant galaxies among the most distant ever seen, appears to be unusually massive and mature for its place in the young universe as shown in Fig. 4, which represents an era when the universe was only 800 million years old after the Big Bang [11].

That is about five percent of the Universe's age of 15 billion years. This is against to common thought that galaxies have been much smaller associations of stars that gradually merged to build large galaxies like our Milky Way. Hence it is considered that the age of the Universe must be much older than the estimated value obtained by the Big Bang theory.

In view of many problems with the big bang theory, we must postulate alternative cosmologies from the standpoint of the electromagnetic zero-point field of the vacuum.

5. CONCLUSION

According to the quantum physics, the vacuum in the Universe is filled with ZPF energy field. From which, vertual particles including tachyons can be generated constantly in a vacuum. The author has shown that cosmic background radiation may be the Cherenkov radiation radiated from tachyon pairs created from ZPF field. By utilizing this theory, there is a possibility that highly thermal radiation can be created by the Cherenkov radiation from vertual tachyons as shown by the ratio of total energy radiated from the heat source and Cherenkov radiation from tachyon pairs versus the net radiated energy from heat source at high temperature. From the theoretical analysis, it can been seen that high energy radiation will enhance this Cherenkov radiation from the ZPF field in a vacuum and this may lead to the instability of space-time continuum over the temperature more than 10^{14} °K .

From this result, the Universe couldn't be created as claimed by the Big Bang theory, which estimated the temperature of the new born Universe to be 10^{32} °K , and hence we must reconsider the origin of our Universe.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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