Changes in Space-time configuration of CMB for a role in Vacuum fluctuations

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Abstract

Analysis, that introduces from relativity theory, originals relationships between radiation energy and its space coordinate. The latter, even for spontaneous process, shows changes of such magnitude, which could be correlated with the duality configuration photon-wavelength. Parametric up-conversion, in which two photons generate one of half wavelength, may allow Cosmic Microwave Background (CMB) photons to shrink within their locus space-time configuration (Casimir Effect). CMB Parametric up- and down-conversion could allow CMB wavelength fluctuations in vacuum. These, could be difficult to detect because may occur within the range of its black body spectra (between 5×10^{-1} cm. to 2×10^{-1} cm.). The relic CMB photons, by number (411 cm^3), and by their very low energy (2.71 K), means a large space-time dimension may be, therefore, not only dimensioning the vacuum, but also generating its fluctuations.

Results

A simulation, by applying a wave function treatment to Planck energy limit (E_P) resulted in a Big-Bang description, in which, the evolution of the space-time, surges naturally as analogous to a continuum of decreasing frequency (ν) (Figure 1). The De Broglie duality concept could be further enriched by parameters obtained from relativistic theory. These, like time of localization (t_{loc}), describe the duality in terms of space-time dimensional differences, suggesting two configurations of same energy. From this treatment, could be shown as demonstrated below that electromagnetic radiation, yields different values for the localization of its energy, when dimensioning into a wavelength (λ) or photon (γ).

Thus, applying to the Plank Energy Limit (E_{P}) = 1.22×10^{22} MeV

Equation 1: $\lambda / t_{\lambda-loc} = c$, velocity of light in vacuum (c) = 2.997×10^{10} cm/s $\therefore$ $\lambda / c = t_{\lambda-loc}$, 3.389×10^{-43} s that also results from: $1/\nu$, ν: frequency.

Equation 2: for a particle t_{p-loc} or γ: $2r / t_{\gamma-loc} = c$ and $2r / c = 5.39121\times10^{-44}\mathrm{s}$.

Same value results from: $t_{Pl} = \left(hG / 2\pi c^5\right)^{1/2}$ (G: gravitational constant, h: Planck constant). For E_{P}: $3.389\times10^{-43} / 5.391\times10^{-44} = 2\pi$ $\therefore$ $t_{\lambda-loc} / t_{p-loc} = 2\pi$. Replacing in equation 2: $2r / t_{\lambda-loc} / 2\pi = c$.

Equation 3: relating equations 1 and $2\dfrac{\lambda}{t_{\lambda-loc}} = \dfrac{4\pi\, r}{t_{\lambda-loc}}$.

Under figure 1 is shown that a different value, Compton (λ_c), defined by observation of the interaction between electron and photons, could be applied. The preceding indicates that $t_{\lambda-loc}$ and volume of localization ($\mathrm{V}_{\lambda-loc}$) could be used to determine space-time changes in configuration for photons [1].

Hence, allowing that the latter measurements, originated from relativistic theory, could be applied as a complementary description to the one originated from quantum mechanics. Thus, changes in the space-time configuration of photons were applied into a relativistic continuum, surging from the description of energy evolution from E_P into relic Cosmic Microwave Background Radiation (CMB) (Figure 1). Relativity theory, predicts that, vacuum exists as and because is a *locus* of energy. Absence of matter in vacuum does not mean absence of energy, because of the presence of CMB. Vacuum manifestations, should therefore, include the dynamics of CMB.

The inter-conversion of energy configuration of CMB, either by the duality or by spontaneous parametric down-conversion (PDC) [2, 3] could be expected to produce changes in $t_{\lambda-loc}$ and $V_{\lambda-loc}$. Therefore, CMB should be evaluated for a role in space-time modifications, which may include or not the presence of virtual or dark energy [4]. Hence, experiments in CMB-free vacuum may be required to exclude the possibility of CMB interference in the measuring of black or virtual energy. CMB capability to react in the direction of parametric up-conversion (PUC) was estimated by the Casimir effect. The integration of two relic CMB photons into one with twice the energy reduces initial volume by a large factor. As shown for a λc-volume ($V_{\lambda-loc} = 2\times10^{-3}$ cm$^3\times2=$ 4×10^{-3} cm^3) would lead to attraction between the plates.

A system to evaluate phenomena in presence and absence of CMB is suggested by the experimental conditions used to evaluate the Casimir effect.

The technique would consist in that, by joining two plates transparent to CMB, it would expected to have the effect of excluding CMB from within the plates. After, by attaching opaque plates to the transparent one, may prevent the reentering of CMB into the space delimited by the plates. This methodology could be expected to obtain a CMB-free vacuum.

The control would be that by separating these plates, now it could be restarted the experiment in the absence of CMB and, therefore, measure if there is a remnant of energy capable to sustain again a Casimir effect of attraction between plates. Only if such is the case, could be assumed that the Casimir Effect is not due to CMB, but to either virtual or dark energy [4]. Also, similar methodology could be used to measure the velocity of propagation of light within a CMB-free vacuum.

The velocity of light changes when propagating through solvents and upon salt additions, and could be progressively decreased, up to reach its confinement [6, 7, 8]. According to equation 1, a decrease in the velocity of light has to implicate a concomitant decrease of λ, and/or an increase in $t_{\lambda-loc}$. Since, a decrease in λ should be excluded, because it implicates energy increments, the dominant effect should be large increases in $t_{\lambda-loc}$. Hence, the thermodynamic structure within the confinement locus, results in that the space-time and the energy parameters of the photons, becomes uncoupled allowing the delocalization of the energy from its locus, as photon into the confinement media.

The very low value, for the mean energy of the black body distribution of CMB photons, in the vacuum = 2.35×10^{-4} eV, leads to predict minimum effects on atoms, but of the same order than that obtained, when measuring the vacuum effects on atoms [9]. If found that the dominant effect could be attributed to CMB. This raises the possibility that PDC and PUC, by changing $n\gamma$ and the dimensional values of CMB, could be a source for vacuum fluctuations [5].

An iterative treatment by PDC 106 times (stages) allows reaching the coordinates space-times values of relic CMB: 5.27×10^{-01}cm/ 1.76×10^{-11}s. Black body spectra of relic CMB would be in a range from the latter values to less than 2×10^{-01}cm, this would may difficult to detect wavelength fluctuations. After separation of forces at $t_{\lambda-loc} =$ 1.456×10^{-33}s, inflation ends at about 2.84×10^{12} MeV. Photon transfer to the generation of dark energy, ordinary mater and dark energy, maintain constant nγ from stages 56 to 70, increasing thereafter to present nγ of CMB = 3.7×10^{87}. The

Compton radius (r_c) of interaction of a photon with an electron (λ_c) = $\lambda/2\pi$. Hence, λ_c for λ value of E_P 1.016×10^{-32} and divided by 2π is 1.616×10^{-33} cm or Planck length. The Compton volume for λ_c localization: $V_{\lambda-loc} = 4/3\times\pi\times\lambda_c{}^3$ for E_P is 1.772×10^{-98} cm^3, which multiply by $n\gamma_{in}$ 1.4×10^{60} = 2.48×10^{-38} cm^3 or Big-Bang initial volume. Another simulation was based in that the initial volume corresponded to a single Planck locus. Hence, from an hypothetic hyper-space the flow of energy was delimited by each photon division, allowing a sixteen times increment of the space-time which sequential inflow of sixteen Planck photons, to reach a photon number $n\gamma_{in}$ 1.4×10^{60} before have elapsed 1/1000 of the inflationary Era.

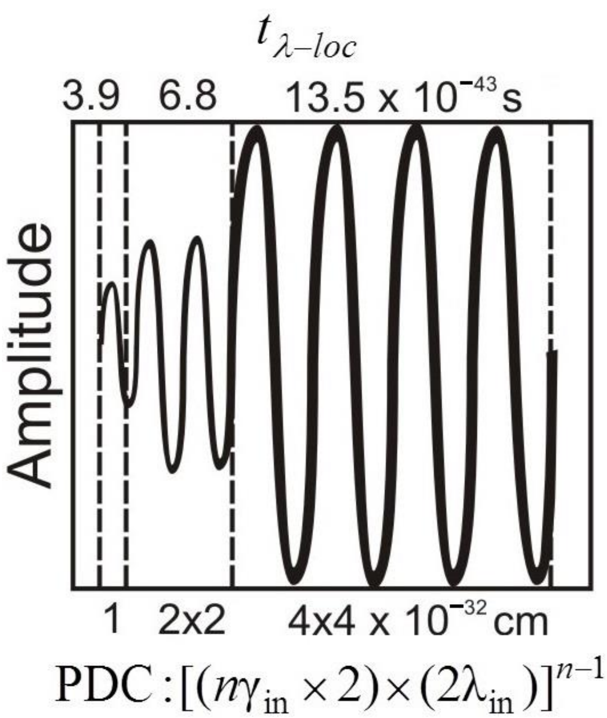

Figure 1: Simulation of the unfolding of a self-contained universe by PDC. Total cosmic energy = 1.7×10^{82} MeV divided by E_P = initial number of photon ($n\gamma_{in}$) = 1.4×10^{60}. Hence, E_P space-time coordinates (or initial) by Equation 1: $\lambda/t_{\lambda-loc}$ or 1×10^{-32}cm/3.39×10^{-43}s, by applying PDC $((n\gamma_{in}\times2)\times(2\lambda_{in}))^{n-1}$ allows that a photon generates two of half energy and also doubles their λ and $t_{\lambda-loc}$ values, in order that a constant ratio equals c.

Conclusions

Standard values for the relic CMB photon number ($n\gamma$) = 3.79×10^{87}, multiplied by their $V_{\lambda-loc}$ = 2.47×10^{-03} cm^3 =9.3×10^{84} cm^3 or present universe volume. Accordingly, CMB photons even representing only 0.04% of total cosmic energy, by their increasing volume and number, appear to be tightly filing and dimensioning the vacuum within the space-time. Hence, mass-less CMB by γ-number increment and λ-elongation, as well as propagating as a radiation, not subject to gravity, would have antigravity effects similarly to that of dark energy. Thus, it could be proposed that CMB could also be considered as leading or participating in the vacuum expansionary process, continually increasing the distance between galaxies.

Dark energy presently holds more than two thirds of total cosmic energy, and has been predicted as filling the space. However, in terms of the dimensioning of the cosmic vacuum, either by volume or by its quanta number, the presently detected 411 CMB photons per cm^3 could have the dominant effect. It has been reported up to 160 times of spontaneous inter-conversions [2, 3], between parametric up- and down-conversion.

If PDC reaches equilibrium of inter-conversion with PUC, this may not affect significantly the black body energy distribution of CMB, but these wavelength fluctuations may be detected as strong fluctuations in the vacuum structure of the space.

The down conversion increases number and volume of CMB photons [2, 3], stretching space whereas the up-conversion would be contracting space. These space fluctuations could be therefore detected without significant energy exchanges.

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