CMB radiation and the Casimir effect

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Abstract

Parametric down-conversion (PDC) and parametric up-conversion (PUC) had been experimentally observed as spontaneous energy conservation processes. The first one could increase cosmic entropy by decreasing energy density. In a Casimir effect experiment could be calculated that the space between plates contracts, because PUC allows that from every two, low energy Cosmic Microwave Background (CMB) photons could be created one of higher energy. This decrease in photon number and increase in photon energy density allow shrinking of the volume of CMB photon localization. This effect reduces initial volume to 6.25% per each pair of integrated photons. This process would be observable as a decrease of the space separating the parallel plates. The higher energy photons are generated from CMB-containing (constituted?) vacuum, and therefore, could be inconsistently attributed as coming out of nothingness an assumption reserved to virtual energy in accordance to Heisenberg's uncertainty principle. CMB is subject to gravity, but its elongation by PDC is not. Accordingly, PDC present splitting CMB rate was evaluated as equivalent to that of the Hubble's constant (H_0). PDC continuously generates new photons, the summa of their radius could be assumed to reach a length of about to 70 km per Mpc per second. This value, because the photons emerge uniformly into space, would add as the summa of the number of parsecs that separates two galaxies. Accordingly, multiplying the PDC equivalent to H_0 70 km/sec by a distance of about 4300 Mpc, the inter-galactic velocity of recession would approach that of the propagation of light in vacuum. However, the photon themselves are only expanding to expand CMB intergalactic vacuum.

Introduction

CMB packets with a mean wavelength (λ) of 5.27×10^{-1} cm, at the presently detectable density of 411 photons per cm^3 yielding a total cosmic photon number (nγ) equal to 3.78×10^{87} photons [1]. The present volume of the universe (V_U) corresponds to the cosmic (nγ) multiplied by the volume of λ-localization ($V_{\lambda c-loc}$). This one, by analogy, calculated according to the Compton wavelength (λ_c) from the equivalence between an electron and its wavelength volume: $V_{\lambda c-loc} = 4/3\times\pi\times{\lambda_c}^3$. Hence, the CMB even at its present low energy level of 2.35×10^{-4} eV, may be, therefore, dimensioning the cosmos with the radius 13.7×10^9 light years. Accordingly, it could be assumed that the description of vacuum as identical to empty space is far from accurate [2].

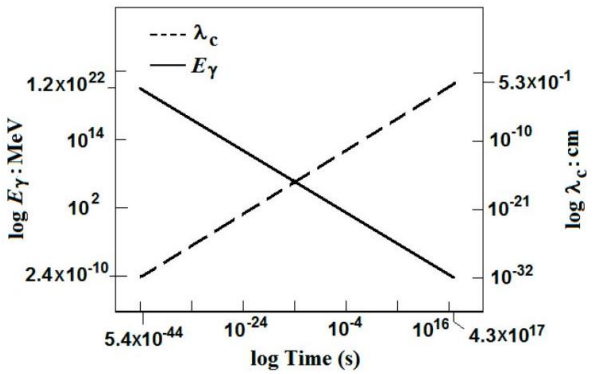

Figure 1: *The decrease by PDC of the energy density (*$\log E_\gamma$*: MeV) and corresponding increment of the Compton reactive radius (*$\log\lambda_c$*: cm) per CMB photon, as a function of the increment of Cosmic time (log Time: s).*

Figure 1 shows a correlation between the elongation curve for CMB calculated as a Compton radius (λ_c) and the photon decrease in

energy (E_γ). The present volume of the universe (V_U) corresponds to the cosmic number of photons (nγ) multiplied by the volume of λ-localization ($V_{\lambda c-loc}$). The latter, calculated according to the Compton wavelength (λ_c) measured by experimental collision interaction between an electron and a photon: $V_{\lambda c-loc} = 4/3 \times \pi \times \lambda_c{}^3$.

The ubiquitous presence of CMB may allow that its possible physical interactions within a boundary system formed by proximal conducting parallel plates could have incidence in the results measuring the Casimir Effect. Experiments were usually carried on using other plates than those made with material transparent to CMB [3, 4], preventing equilibriums between CMB in the inside with that outside the plates, confining those within the inside. These non-transparent plates would allow an initial condition of equilibrium of photons CMB pressure which may not be sustainable, because if the plates are conductive could withdraw from the inside the initially confined CMB packets. This effect would decrease the nγ enclosed and therefore the summa of their: $V_{\lambda c-loc}$ would occupy a smaller space allowing the plates to show mutual attraction.

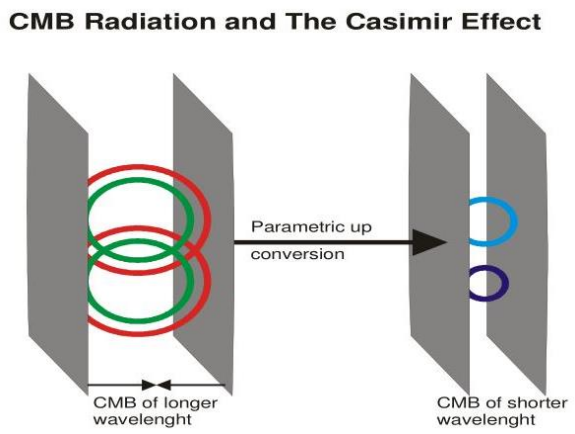

Figure 2: *Illustration of photon parametric conversion. CMB detectable concentration of 411 photons per cm^3, photon overlapping within a confinement space by parametric up-conversion would allow two photons integrating to create one of shorter wavelength. This decrease in photon number and increase in photon energy density allows shrinking of the volume of photon localization. This process would be observable as an attraction between parallel plates.*

An exterior photon pressure may produce space confinement of CMB leading to a photon overlapping resulting in parametric up-conversion. This process permit that two photons of low energy became integrated into one of higher energy, but shorter wavelength (figure 2). The calculation for the integration of two actual CMB photons (with $V_{\lambda c-loc}$ of 2.47×10^{-3} cm$^3\times2$ $=4.94\times10^{-3}$ cm^3) into one with twice the energy reduces initial volume to a $V_{\lambda c-loc}$ 3.09×10^{-4} cm^3. The remaining volume per photon pair would be 6.25%.

Some of the geometries utilized to measure the Casimir effect had been reported to result in a repulsive force [4]. Laboratory experiments show wavelength elongation [5]. The later also occurs as a parametric down-conversion [6] in which a photon could split into two, each one with half the initial energy and each duplicating initial wavelength. Thus, increase nγ and wavelength of CMB expanding into a greater volume of localization. Consequently, the increase volume may appear to result from a repulsive effect.

Connes postulates the geometrical coexistence between a non-continuum and a continuum [7]. The simulation adapted this concept to that of coexistent thermodynamic structures, in which the non-continuum is constituted by ordinary and dark matter and the continuum, by that of the evolution of initial radiation and dark energy. Hence, vacuum represents space voids of matter in the non-continuous structure, but, for the continuous structure absence of energy, would be equivalent to the absence of space itself. This does not contradict the premise that increasing energy density allows space to shrink (figure 2). At the enunciation of the relativity theory [8], CMB had not yet been detected, but Einstein's description unifying space, time and energy as a continuum implies that without energy, the space continuum will be absent or collapse [9].

Conclusions

The interference of CMB radiation in the Casimir effect is discussed. An exterior photon pressure on the parallel plates may lead CMB into a parametric up-conversion process.

PUC allows two photons of the CMB, of low energy and large Compton volume locus, to become integrated into one of higher energy, but shorter wavelength and smaller by 93.75% locus. PUC, the interaction of two photons to generate one, is not kinetically favored over its opposite direction, PDC.

Parametric up- and down-conversions are spontaneous processes, however if the lattices of the Casimir plates, are more transparent to smaller photons, PUC, as a reaction, would tend to completion, because as the smaller photons leaves the internal space decreasing their mass participation on equilibrium, leading to the shrinking of space (example: a reaction producing a gas or a precipitation, etc.).

PDC, from of the Era of last dispersion to the present, produces an increment in CMB-photon number from 3.44×10^{84} to 3.78×10^{87}. Total energy during spontaneous up or down reactions is conserved, but PDC increases entropy by decreasing energy density, as a function of increasing cosmic vacuum volume.

Any energy emerging from vacuum could be expected to contribute with its volume of localization to an increase of volume within the Casimir plates decreasing attractive effects. Emerging of dark energy into ordinary space, if a possibility, may have similar effect. However, energy transfer from ordinary to virtual space would allow a decrease of the enclosed volume, but this could not be conceptualized as energy emerging from vacuum.

References

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