

The Color of the Night

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Abstract

Light coming from remote galaxies is redshifted and it is accepted that redshifts are produced by every galaxy running away from each other in a particular manner. According to this theory, galaxies can be grouped by the distance to earth in four spaces: the closer ones with no acceleration, the next ones with acceleration, the next remote ones with deceleration, and the farther ones without characterization. All that complexity is disregarded in this paper by assuming that the photons are ruled by longitudinal and transverse gravitational potentials. These relativistic invariant potentials create coherence quantum states of energy and subsequently the light redshift is created by photons moving down across those energetical levels.

Keywords

Redshift, Background, Expansion, Acceleration, Universe, Cosmos

1. Introduction

People first assumed that heaven was eternal, and nobody was expected signals from the past. Penzias and Wilson [1] in 1965 reported a rare radiation coming from space. Scientists as Alpher, Herman, Zel'dovich, Dicke, Doroshkevich, and Novicov are mentioned in [2] to have been working with the prediction and detection of a signal relate to the entire universe. Then, it was logical that the predictions in [3] [4] [5] were correlated with the experimental observations of Penzias and Wilson. In the same period, Hubble discovers [6] that light coming from all far galaxies has a redshift proportional to its distance to us. That redshifted was interpreted as a Doppler's effect [7] according to galaxies flying away from each other with a speed proportional to its distances. All mentioned before correlated well within a theory that is known today as the Big Bang (BB). See for example [8]. Anyway, some science-men as Arp [9] and Mitchell [10] express strong disagreement with the BB theory.

The determination of the so-called Hubble's constant H_0 indicates in 2020 that something could be wrong. That constant is correlated with the universe expansion rate according to Riess [11]. The Shahib's *et al.* [12] $_{-3.0}^{+2.7} 74.2$ km·s⁻¹·Mpc⁻¹ value does not overlap with the Aghanin's *et al.* [13] $_{-0.5}^{+0.5} 67.4$ km·s⁻¹·Mpc⁻¹ value. Interesting, they used different techniques. The former team used three bands of the Hubble Space Telescope observing the strong lens system DES J0408-5354 and the latter team measured the cosmic microwave background (CMB) anisotropies. This paper is about the mechanics that create the CMB radiation and the reason why those H_0 values are different, according to Menin's idea [14].

In [15] was introduced the idea that photons because the potential of interaction between them, can develop a coherence condition characterizes with quantized energetical states. The idea of light going down on those energetic levels during traveling can be used to explain the three regions of space that are been characterized now with a null acceleration, a positive acceleration, and a negative acceleration [11]. It is this paper is about balancing an apparent complex young universe versus a long existing simple universe were traveling light mature with time. According to this point of view, the oldest light can be identified with the CMB.

2. Energetic Photons—Second Part

This paper is about an important consequence of the model introduced in [15]. There, the Dirac's method [16] was used to cover gravitational interactions between photons. The energetical result in [15] called Equation (12) is reintroduced here as Equation (1)

$$E + m\varphi = (E_{star} + m\varphi) \left(\frac{\tau_0}{\tau} \right)^{\frac{c}{c+\Lambda}} \tag{1}$$

were E being the photon energy at time τ , m the photon rest mass, φ the gravitational potential, τ_0 half of the inverse of the Hubble's constant H_0 , c the speed of light, and Λ the universal limit speed. The Dirac's method adapted to gravity required the speed of light to be lower but extremely close to the limit speed.

Defining redshift z as $z = E_0E^{-1} - 1$, where the energetic fraction according to Equation (1), is

$$\frac{E_0}{E} = \frac{1}{(1 + m\varphi E_0^{-1}) \left(\frac{\tau_0}{\tau} \right)^{\frac{c}{c+\Lambda}} - m\varphi E_0^{-1}} \tag{2}$$

were $\tau = \tau_0 + t_T$, $\tau_0 = (2H_0)^{-1}$, and the time of traveling $t_T = dc^{-1}$, if d is the distance traveled. Then, the universal redshift z becomes,

$$z = \frac{1}{(1 + m\varphi E_0^{-1}) (1 + 2H_0 c^{-1} d)^{-\frac{c}{c+\Lambda}} - m\varphi E_0^{-1}} - 1 \tag{3}$$

There is a faraway region on the universe from where the redshift skyrocket.

Equation (3) holds that region when its denominator approach zero. The denominator approach zero if the photon energy at the absorption time is too little in comparison with the original one. Coherence of light can be used to explain the so-called Olbers' paradox. Following Olbers, if the universe is infinite, unchanging, and isotropic, the sky must be bright at night in any point, as indeed is seeing with color 1.0635 mm spatial rate λ .

Equation (3) gives us a measure of the size of the detectable universe because the CMB anisotropy radiation of 1.0631 mm and 1.0639 mm could be associated with redshifts of 1831.93 and 1833.31, respectively. These redshifts were calculated by assuming a universal average star color of 580 nm. Light coming from galaxies at 16,132.845 Mpc and 16,132.875 Mpc away, according to Equation (3), will arrive Earth with those redshifts assuming a 0.5 energetical fraction $m\phi/E_0$. In Earth, we are detecting the ultimate radiation coming from a spherical shell of 30 kiloparsecs width beyond the 16,132.845 Mpc mentioned above. The width of this shell can only contain dwarf galaxies.

Let us image that what we call the Universe is only a granule among other universes not detected yet. Then, there is some probability that we are not observing into the cosmos correctly.

The photon mass upper limit (PMUL) is a good candidate to test the validity of the model introduced in this paper. Kroll in [17], by analyzing the dispersion in the ionosphere, announced a PMUL of 4×10^{-49} kg. Williams, Faller, and Hill in [18], by using Coulombs' Law, put the PMUL in 2×10^{-50} kg. Davis, Goldhaber, and Nieto in [19], by using the Jupiter's magnetic field, improve the PMUL to 7×10^{-52} kg. Ryutov in [20], by using the solar wind magnetic field, set the PMUL in 2×10^{-54} kg. All those PMUL are experimental results and Goldhaber and Nieto referred to them as "secure". Let us take a chance by including two speculative more demanding values as in [21] [22] [23]. The authors, by using the extended Lakes' method, show 10^{-55} kg PMUL and Chibisov in [24], by modeling the cosmic magnetic field, shows 3×10^{-63} kg PMUL.

The photon mass, according to the coherence hypothesis, should satisfy the mix of constants as shown in Equation (4).

$$m_\gamma = \frac{2hH_0}{\Lambda^2} = \frac{2 \times 6.62 \times 10^{-34} \text{ kg} \cdot \text{m} \cdot \text{s}^{-2} \cdot \text{m} \cdot \text{s} \times 74.2 \text{ km} \cdot \text{s}^{-1} \cdot \text{Mpc}^{-1}}{9 \times 10^{10} \text{ km}^2 \cdot \text{s}^{-2}} \quad (4)$$

Equation (4) outputs around 4×10^{-68} kg photon mass. All PMUL values mentioned above make feasible the photon mass stated in this paper.

3. Conclusion

The known universe is seen as having closer galaxies running away with constant velocities proportional to its separations, intermediate galaxies with accelerating velocities, farther galaxies with decelerating velocities, and a universal explosion followed by an inflation from where is detecting a CMB radiation. That opinion is created by the properties of the radiation coming from those galaxies and its surrounding space. Same properties are explained here by a unique

idea. All the universal experimental information available to us now is consistent with the coherence state of light that forces photons to discretely loss energy during its traveling.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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