

Short Communication

Cumulative-Phase-Alteration of Galactic-Light Passing Through Cosmic-Microwave-Background: A Possible Mechanism for Some Spectral-Shifts

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This paper proposes a new mechanism for the red-shift in the extra-galactic-light; as well as a new kind of blue-shift reported here, and their observational evidences. These spectral-shifts result due to cumulative phase-alteration of extra-galactic-light because of vector-addition of: (i) electric-field of extra-galactic-light and (ii) that of the cosmic-microwave-background (CMB). Since the center-frequency of CMB is much lower than extra-galactic-light, the cumulative-phase-alteration results in *red*-shift, observed as an additional contributor to the measured 'cosmological red-shift'; and since the center-frequency of CMB is higher than the radio-frequency-signals used to measure velocity of Pioneer-10, Pioneer-11, Galileo and Ulysses space-probes, the cumulative-phase-alteration resulted in *blue*-shift, leading to the interpretation of deceleration of these space-probes, comparable in magnitude with the 'deceleration experienced by the cosmic-photons'. Possible verification-experiments for this new mechanism are also proposed.

Key Words: Cosmological Red-shift; Pioneer Anomaly; Cosmic Microwave Background (CMB); Cumulative Phase-Alteration

1. Introduction

The 'cosmological red-shift' is currently understood in terms of 'metric-expansion-of-space'. This interpretation leads to: (i) 'big-bang', that is: coming out of such a huge universe from an infinitesimally small point, that is, non-confirmation of 'the law of conservation of energy', energy coming out of nothing; and (ii) loss of energy of the 'cosmologically red-shifted photons, that is, total loss of energy. Therefore, many scientists are searching for alternative-interpretations of 'the cosmological red-shift', see for example, the Wikipedia-page on 'alternative-cosmologies'. We find that the alternatives proposed so far were rather speculative; for example, speculating about possible presence of iron-particles in the inter-galactic-space, or presence of atoms of gas, or electrons, or virtual-particles etc.

How can we say for sure that such particles are indeed there in the inter-galactic-space? Even if they are there, is the 'cross-section' of their interactions sufficient? Whereas a mechanism proposed here is based on experimentally established facts, namely the presence of 'cosmic-microwave-background' (CMB), we are sure that CMB is indeed present in the inter-galactic-space. And we know for sure that electric-fields of light and CMB are sure to get added vectorially. Moreover, with this mechanism it is possible to predict both kinds of spectral-shifts; and observational-evidences for both kinds of spectral-shifts are indicated here. In this new mechanism there is no loss of energy; energy lost by cosmic-photons get transferred to CMB, in agreement with the law of conservation of energy. Possible verification-experiments for this new mechanism are also proposed, so it is a testable proposal.

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Moreover, this proposal does not contradict with the existing theories of cosmology, because it does not lead to a conclusion that whole of the measured ‘cosmological red-shift’ is due to this ‘cumulative-phase-alteration-mechanism’; some part of the red-shift must be really due to ‘metric-expansion-of-space’. This new mechanism may only reduce the requirement of total-mass-of-the-universe, closer to the observable baryonic matter, making it sufficient for the required ‘closer-density’. Thus, this new mechanism of spectral-shift is likely to resolve some of the problems of the current Standard Model of Cosmology.

2. Cumulative Phase-Alteration of the Extra-Galactic-Light Passing Through Cosmic-Microwave-Background (CMB)

Let us imagine a horizontal arrow of three centimeter length representing instantaneous magnitude and direction of electric-field of the ‘extra-galactic-light’. Then add a small arrow of just five mm length at an angle minus thirty degrees, representing instantaneous magnitude and direction of the ‘cosmic-microwave-background’. We can see that the resultant vector has increased in magnitude, but lagged behind by a small angle theta. As the wave of extra-galactic-light travels in space, a new arrow representing CMB keeps on getting added to the previous resultant-vector. This kind of phase and amplitude-alterations continue for billions of years in the case of ‘extra-galactic-light’; producing a cumulative-effect. Since the speed of rotation of the vector representing CMB is much slower than that of light, the CMB-vector pulls-back the Light-vector resulting in reduction of cyclic-rotations. This process can be mathematically expressed as follows:

Electric field of pure light-wave can be expressed as:

$$\Psi(X, t) = A [\cos \omega t + i \sin \omega t] \quad (1)$$

when electric-fields of CMB get added, the resultant-sum can be expressed as:

$$\Psi(X, t) = A [N(t) \cos \omega t + i N^\wedge(t) \sin \omega t] \quad (2)$$

where, ω represents a frequency-component of extra-

galactic-light, $N(t)$ represents instantaneous magnitude of alteration caused by CMB, and $N^\wedge(t)$ represents its Hilbert-transform. When all the spectral-components of $N(t)$ are phase-shifted by +90 degrees, we get its Hilbert-transform $N^\wedge(t)$.

As a communications-engineer we use band-pass-filter to remove out-of-band noise. This author has also developed a noise-cancelling-technique, to reduce the effect of even in-band-noise by up-to 10 dB. But in the extra-galactic-space there are no band-pass-filters, so the phase-alterations caused by CMB keep on getting accumulated. After billions of years, when this light reaches our planet earth there is a cumulative-phase-alteration in the extra-galactic-light, observed as a part of ‘the cosmological red-shift’. Since the center-frequency of CMB is much lower than extra-galactic-light, the cumulative-phase-alteration results in *red*-shift; and since the center-frequency of CMB is higher than the radio-frequency-signals (2110 MHz for the uplink from Earth and 2292 MHz for the downlink to Earth) used to measure velocity of Pioneer-10, Pioneer-11, Galileo and Ulysses space-probes, the cumulative-phase-alteration resulted in *blue*-shift, leading to the interpretation of deceleration of these space-probes. C. Johan Masreliez has already presented a ‘cosmological explanation for the Pioneer-anomaly’, in terms of expansion of space, whereas here it is proposed that the expansion-of-space appears mostly due to the ‘cumulative-phase-alteration of light due to CMB. This shows that there is a correlation between the magnitude of anomalous-accelerations of the Pioneer-10-11 space-probes and the ‘cosmological red-shift’. Although, one of the shifts is *red*-shift, and the other is *blue*-shift, their magnitudes, in terms of decelerations, are strikingly the same; as described in detail in the next paragraph:

We can express the cosmological red-shift z_c in terms of de-acceleration experienced by the photon, as follows (Tank, 2010, 2011):

For z_c smaller than one:

$$z_c = (f_0 - f)/f = H_0 D/c$$

i.e. $(h\Delta f/hf) = H_0 D/c$

$$\text{i.e. } h \Delta f = (hf/c^2) (H_0 c) D \quad (3)$$

That is, the loss in energy of the photon is equal to its mass (hf/c^2) times the acceleration $a = H_0 c$, times the distance D travelled by it where, H_0 is Hubble-parameter. And the value of constant acceleration a is: $a = H_0 c$, $a = 6.87 \times 10^{-10} \text{ m/s}^2$.

And now, we will see that the accelerations experienced by the Pioneer-10, Pioneer-11, Galileo and Ulysses space-probes do match strikingly with the expression (8):

Carefully observed values of de-accelerations [1]:

For Pioneer-10,

$$a = (8.09 \pm 0.2) \times 10^{-10} \text{ m/s}^2 = H_0 c \pm \text{local-effect} \quad (4)$$

For Pioneer-11,

$$a = (8.56 \pm 0.15) \times 10^{-10} \text{ m/s}^2 = H_0 c \pm \text{local-effect} \quad (5)$$

For Ulysses,

$$a = (12 \pm 3) \times 10^{-10} \text{ m/s}^2 = H_0 c \pm \text{local-effect.} \quad (6)$$

For Galileo,

$$a = (8.0 \pm 3) \times 10^{-10} \text{ m/s}^2 = H_0 c \pm \text{local-effect,} \quad (7)$$

and

As we already derived earlier, for the ‘cosmologically-red-shifted-photon’,

$$a = 6.87 \times 10^{-10} \text{ m/s}^2 = H_0 c \quad (8)$$

This value of acceleration is also the ‘critical acceleration’ of modified Newtonian dynamics MOND (9);

and the rate of ‘accelerated-expansion’ of the universe (10)

Perfect matching of values of decelerations of all the four space-probes is itself an interesting observation; and its matching with the deceleration of cosmologically-red-shifting-photons cannot be ignored by a scientific mind as a coincidence. There

is one more interesting thing about the value of this deceleration as first noticed by Milgrom, that: with this value of deceleration, an object moving with the speed of light would come to rest exactly after the time T_0 which is the age of the universe.

Possible Verification-Experiments

Vector-addition of light and CMB can be simulated using computers. The vector to be added to light-vector can be derived from the actual CMB received. Every time new and new CMB-vector can be added to the resultant vector of previous addition.

Secondly, we know that there is certain amount of un-isotropy in the CMB; that is, microwaves coming from some directions are more powerful than from other directions. So, we can look for any correlation between the strength of CMB from a given direction and value of cosmological-red-shift of stars at the same luminosity-distances.

Thirdly, we can establish a ‘reverberating-satellite-link’, in which we can first transmit a highly-stable frequency to geo-synchronous-satellite; receive the signal back; re-transmit the CMB-noise-corrupted-signal back to satellite, and continue such repetitions for an year or longer and compare the frequency of the signal with the stable source.

Conclusion

After getting the results of verification-experiments, the new mechanism proposed here namely: ‘Cumulative Phase-Alteration of the Extra-Galactic-Light passing through Cosmic-Microwave-Background (CMB)’ it seems possible to explain: not only the large percentage of ‘cosmological red-shift’, but also the Pioneer-anomaly. After separation of the contribution of spectral-shifts due to this new mechanism, from the measured values of the ‘cosmological red-shifts’ the requirement of total-mass of the universe may come very close to the already-observable baryonic matter; resolving the problem of ‘dark-energy’ from the current standard-model-cosmology.

References

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