Is the expansion of universe accelerating or the photons decelerating?

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Abstract:

Astronomical observations of cosmological red-shift are currently interpreted in terms of 'expansion of universe' and 'accelerated-expansion of the universe', at the rate of $H_0\, c$; here H_0 is Hubble's constant, and c is the speed of light. Whereas a straight forward derivation presented here suggests that: rather it is the photon which is decelerating, at the rate of $H_0\, c$. Such a deceleration of photons can be caused by virtual electrons, positrons and pi-mesons, contained in the extra galactic quantum vacuum, because: they do have gravitational-acceleration of the same order as $H_0\, c$ at their "surfaces"; or by decay of photon into a lighter photon and a particle of mass $h\, H_0 / c^2$.

1. Introduction:

E.P. Hubble's observations of 'cosmological red-shift', and subsequent observations till today, are currently interpreted in terms of 'expansion of the universe' and accelerated-expansion of the universe at the rate $H_0\, c$. Whereas a straight forward derivation presented here suggests that: rather it is the photon which is decelerating, at the rate of $H_0\, c$. Tired-light interpretations of cosmological red-shift' were so far considered as not compatible with the observations of 'time-dilation of super-novae light-curves'; so in a paper titled: "Wave-theoretical insight into the relativistic 'length-contraction' and 'time-dilation of super-novae light-curves'" [1] it has been already shown that any mechanism which can cause 'cosmological red-shift' will also cause 'time-dilation of super-novae light-curves'. Therefore, we now need not remain confined to the Big Bang model of cosmology.

Martin Lopez-Corredoira [2] applied Alcock-Paczynski cosmological test to six candidate cosmological models; and reached a conclusion that only two of them, namely lambda-CDM and static universe with tired light interpretation of the cosmological red-shift, fit the data.

Cosmologists have accepted the 'space-expansion-interpretation' of the 'cosmological red-shift', as it matches with Einstein's General Theory of Relativity (GR), which predicted 'expansion of space'. This author has been arguing that 'expansion of space' of GR is a 'mathematical terminology' not a physical phenomenon; because: as per GR, if the space between the galaxies is expanding , but the space within the galaxy is not doing so, as a galaxy is a gravitationally-bound structure, then what happens at the boundary of the galaxy? Such uneven expansion of glass would break the glass, and may tear off the space, if expansion-of-space were a physically-real phenomenon. Recently, Ling Jun Wang, [3] in an article, "On the Flatness of Space-time" has rigorously proven that curvature and expansion of space-time are mathematical entities, not the physically real curvature or expansion of space. So, the static universe with tired-light explanation has remained the only candidate. In this paper 'cosmological red-shift' is explained in terms of deceleration of photons caused by virtual electrons and pi-mesons contained in the extra galactic quantum vacuum. And, as supportive evidence, it is shown here that virtual electrons and pi-mesons do have gravitational-acceleration of the order $H_0\, c$ at their "surfaces". As a further

supportive evidence for this proposal, it is shown that even the space-probes Pioneer-10, Pioneer-11, Galileo and Ulysses too, did decelerate at the same rate $H_0\ c$ [4].

2. The Derivations:

(i) It is currently believed that the expansion of the universe is getting accelerated at the rate $H_0\ c$. The following derivation suggests that rather it is the cosmologically red-shifting photon, which is decelerating at the same rate. The linear part of the cosmological red-shift is expressed as:

$z_c = h\ \Delta f / h f = H_0\ D / c$

That is, the loss in energy of the photon, at a distance D, is:

$h\ \Delta f = (h f / c^2)\ (H_0\ c)\ D$ ……..……(1)

That is, the loss in energy of the photon at a distance D is equal to its "mass" times the acceleration ($H_0\ c$) times the distance D. Whether the expansion of the universe is accelerating, is still a hypothesis; whereas the cosmologically red-shifting photon is decelerating at the same rate ($H_0\ c$), as found here, is an experimentally observed fact.

The mechanisms, which can cause such a deceleration of the photons, can be explained as follows:

(a) The inter-galactic space is not a void extension of nothingness. As per quantum mechanics, pairs of virtual particle-and-antiparticles keep on coming in existence for small durations of time permitted by 'Heisenberg's uncertainty principle'. There are many pairs of virtual particles always present in the path of inter-galactic photons. The gravitational-acceleration at the "surface" of these particles is of the order of $H_0\ c$ as shown blow: So all these virtual particles, bit by bit, keep on causing 'gravitational red-shift' in the inter-galactic photons.

Gravitational acceleration at the "surface" of the electron:

$a_e = G\ m_e / (e^2 / 2\ m_e\ c^2)^2 = H_0\ c$ ……(2)

Gravitational acceleration at the surface of the pi-meson can also be derived from Steven Weinberg's formula, that $m_{pi} = [\ h^2\ H_0 / c\ G]^{1/3}$

i.e. $G\ m_{pi} / (\ h / m_{pi}\ c\ )^2 = H_0\ c$ ……..(3)

Even the accelerations at the "surface" of the nucleus-of-atom, the globular-clusters, the spiral-galaxies, and the galactic-clusters too, are of the order of $H_0\ c$ as Siveram C. [5] has numerically found:

(i) For a typical atomic nucleus of mass m_n , *(A = 150)*

$a = G\ m_n / r_n^2 \sim 1.0 \times 10^{-10}$ m / s^2

(ii) For a globular cluster of mass 10^6 solar-masses and radius R_g = 100 pc,

$a = G\ M_g / R_g^2 \sim 10^{-10}$ m / s^2

(iii) For a spiral galaxy of mass $M_{gal} = 10^{12}$ solar-masses and radius R_{gal} = 30 kpc,

$a = G\ M_{\rm gal} / R_{gal}^2 \sim 0.8 \times 10^{-10}$ m / s^2

(iv) For a typical cluster of galaxies, $M_c = 10^{16}$ solar-masses and radius R_c = 3 Mpc,

$a = G\ M_c / R_c^2 \sim 10^{-10}$ m / s^2

(v) Also, for the observable-universe as a whole, with a density of 10^{-29} grams/ cm^3 and radius $R = 10^{28}$ cm,

$a = c\ H_0 = 6.87 \times 10^{-10}$ m/s^2

(vi) And the value of 'critical acceleration of MOND, $a_0 \sim 10^{-10}$ m / s^2

(ii) As a supportive evidence for the above theory, let us look at the values of decelerations experienced by Pioneer-10, Pioneer-11, Galileo and Ulysses space-probes, [4]:

(i) For Pioneer-10, $a = (8.09 \pm 0.2) \times 10^{-10}$ m / s^2
(ii) For Pioneer-11, $a = (8.56 \pm 0.15) \times 10^{-10}$ m / s^2
(iii) For Ulysses, $a = (12 \pm 3) \times 10^{-10}$ m / s^2
(iv) For Galileo, $a = (8.0 \pm 3) \times 10^{-10}$ m / s^2

All these decelerations are of the same order of magnitude as $H_0\ c = 6.87 \times 10^{-10}$ m/s^2; and match strikingly with the 'critical-acceleration' a_0 of MOND; an extremely rare-probability coincidence. Matching of four different decelerations of the space-probes, in spite of the differences in their mass, velocities and directions,

is itself a striking coincidence; and its matching with the deceleration experienced by the 'cosmologically red-shifting photon' cannot be ignored by a scientific mind as a coincidence. So the atoms contained in the space-probes got decelerated due to the bit-by-bit decelerations caused by the virtual particles. This mechanism is testable in the laboratory. Or:

(b) By decay of photon into a lighter photon and a particle of mass $h\ H_0\ /\ c^2$, at every wavelength traveled by the photon. Experimental detection of a new particle of such a small mass may be difficult but not impossible for the physicists. One of the ways of predicting a new particle is to calculate the missing energy, by applying the law of conservation of energy. The photon does loose a chunk of energy $h\ H_0$ while traveling every distance equal to its every wavelength. This method suggests that a particle of mass $h\ H_0\ /\ c^2$ is likely to exist based on the following argument: The strength ratio of electric forces and strong forces is $\sim e^2/\ h\ c$ and we do find particles of the similar mass-ratio, namely, the mass-ratio of the electron and the pi-meson: $(m_e\ /\ m_{pi}) \sim (\ e^2/\ h\ c)$. Similarly, we can expect the particles with mass-ratio: $(h\ H_0\ /\ c^2)\ /\ m_e) = [(\ G\ m_e\ m_{proton})\ /\ (\ e^2)\ ]$. Interestingly the ratio $(h\ H_0\ /\ c^2)\ /\ m_e)$ is indeed equal to the ratio $[(\ G\ m_e\ m_{proton})\ /\ (\ e^2)\ ]$! Therefore, our expectation of a particle of mass: $(h\ H_0\ /\ c^2)$ is quite reasonable.

3. Summary:

The straight forward derivation presented here suggests that: the extra-galactic photons are decelerating at the rate $H_0\ c$ is an experimentally-observed fact. The gravitational acceleration at the "surface" of the virtual electrons, virtual positrons, virtual pi-mesons, is also of the same order of magnitude as $H_0\ c$, so the gravitational field of the virtual particles bit-by-bit can keep on causing 'gravitational red-shift' in the extra-galactic photons. This reduction in the energy of the photons can explain the observation of 'cosmological red-shift'; provided it stands the test of experimental verification. Possible alternative mechanism proposed here is: decay of the photon into a lighter photon and a new particle of mass: $(h\ H_0\ /\ c^2)$.

References:

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