Some interesting correlations between cosmological red-shift and the strength-ratio of gravitational and electric forces

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Abstract:

This letter reports interesting correlations between cosmological red-shift and the strength-ratio of gravitational and electric forces, which may prove to be a clue to deeper understanding of gravitation and cosmology. Cosmological red-shift, smaller than unity, $z_c = \Delta\lambda / \lambda_0 = [G\, m_p^2 / h\, c]$ times the luminosity-distance measured in the units of a wavelength $[D / \lambda_C]$ where $\lambda_C = (h / m_p\, c)$, the Compton-wavelength of a fundamental-particle pi-meson. Also, the energy lost by cosmologically red-shifted photon can be viewed as due to deceleration experienced by the photon; Energy lost $(h\, \Delta f)$ = mass $(h f / c^2)$ times the acceleration $(H_0\, c)$ times the luminosity-distance D; where the rate of deceleration $(H_0\, c)$ turns out to be equal to the accelerated-expansion of the universe! Thus this letter provides some interesting correlations for the experts to think further.

Detailed description:

The 'cosmological red shift' less than unity, is generally expressed as:

$z_c = \Delta\lambda / \lambda_0 = H_0\, D / c$..(1).

The right-hand-side of expression-1 can be written as:

$H_0\, D / c = h\, H_0 / (h\, c / D)$.

Now, Steven Weinberg [1] has found an interesting relation that:

$m_p^3 = h^2\, H_0 / c\, G$, where, m_p is mass of a fundamental-particle, pi meson.

i.e. $G\, m_p^2 / (h / m_p\, c) = h\, H_0$ . ...(2).

So, from the expressions 1 and 2, we get:

$z_c = \Delta\lambda / \lambda_0 = [G\, m_p^2 / (h / m_p\, c)] / [h\, c / D]$. ……………………...…............(3).

i.e. $z_c = \Delta\lambda / \lambda_0 = [G\, m_p^2 / h\, c]\, [D / (h / m_p\, c)]$, where $(h / m_p\, c)$ is a unit of distance, measured in terms of Compton-wavelength of pi-meson; and the constant $[G\, m_p^2 / h\, c]$ denotes the strength-ratio of gravitational and electric forces.

Or, in terms of energy:

$z_c = h\,\Delta\,\nu / h\,\nu = [G\,m_p^2 / h\,c\,]\,[\,D / (\,h / m_p\,c)]$. ……………………..(4).

That is, the reduction in energy of photon due to cosmological-red-shift is proportional to the strength-ratio of gravitational and electric forces.

Alternatively, let us define z_e as:

$z_e = [\,e^2 / r_e\,] – [\,e^2/ (\,r_e + D)] / [\,e^2 / (\,r_e + D)]$,

where e is electric-charge, r_e is 'classical radius of electron' and D is 'luminosity distance'

i.e. $z_e = e^2\,[\,r_e + D – r_e\,]\,[\,r_e + D] / [\,r_e\,(\,r_e + D)\,e^2\,]$.

i.e. $z_e = D / r_e$.

From Dirac's Large-Number-Coincidence, we know, that:

$(G\,m_e\,m_p / e^2\,) = (\,r_e / R_0\,) = (\,m_p / M_0\,)^{1/2} = 10^{-40}$,

Where M_0 is total mass, and R_0 radius of the universe.

i.e. $z_e = 10^{40}\,(\,D / R_0\,)$. …………………………………………………..(5)

Because: $H_0\,R_0 = c$ and $z_c = H_0\,D / c = D / R_0$. ……………………………(6)

Comparing the expressions (5) and (6), we get:

$z_c = 10^{-40}\,z_e$. ……………………………………………………………..(7)

That is: 'cosmological-red-shift, at a distance D is $(G\,m_e\,m_p /e^2\,)$ times the reduction expected from the 'electrostatic potential energy of an electron at that distance D.

(ii) We can express the cosmological red-shift z_c in terms of de-acceleration experienced by the photon: [2]

For z_c smaller than unity:

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

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

i.e. $h\,\Delta\,f = (h\,f / c^2)\,(H_0\,c)\,D$ ……..(8)

That is, the loss in energy of the photon is equal to its mass $(h\,f / c^2)$ times the deceleration $a = H_0\,c$, times the distance D travelled by it. Where: H_0 is Hubble-parameter. And the value of constant deceleration a is: $a = H_0\,c$, $a = 6.87 \times 10^{-10}$ meter/sec^2 , equal to the rate of said accelerated expansion of the universe!

Discussion:
Supposing there were only two atoms, of appropriate masses, in the universe, such that a photon emitted by atom-1, by partly converting its electrostatic potential-energy into a less exited atom and a photon, which gets cosmologically red-shifted while travelling a distance *D* and then gets absorbed by the other atom-2. This system of two atoms lost a part of their electrostatic potential energy. Will this lost energy manifest as 'gravitational-potential-energy' of the system of these two atoms?

Summary:
We presented here two interesting correlations, which are likely to be the clue for deeper understanding of gravitation and cosmology.

References:

Steven Weinberg "Gravitation and Cosmology" (1972) John Willy and Sons, New York

Tank, Hasmukh K. (2011) "Some clues to understand MOND and the accelerated expansion of the universe" AP&SS **336** No.2 p 341-343