Amusing connections among astrophysical parameters

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Abstract

This letter points out some interesting correlations among cosmological parameters, like Hubble's constant H_0, radius of the universe R_0 and total-mass of the universe M_0 which may prove to be a clue to deeper understanding of physics.

Introduction

Unification of gravity with quantum mechanics is one of the major goals of physics. Until this goal is reached, it is advisable to be aware of various coincidences noticed by different researchers. With this philosophy in mind this letter points out some interesting correlations among cosmological parameters.

Derivations

We know that the product of wavelength (λ) and frequency (f) of every electromagnetic wave remains equal to the speed of light c. It means that neither the wavelength nor the frequency of the wave can ever be zero. So they may be having some minimum and maximum values. It is proposed here that physically-meaningful maximum value of frequency is $M_0 c^2/ h$, where M_0 is total mass of the universe, h is Planck's constant, and c the speed of light. And physically-meaningful minimum value of frequency is the Hubble's constant H_0, of the order of magnitude 10^{-18} per second. Similarly, the physically-meaningful maximum value of wavelength, $\lambda_{max} = R_0$, the radius of the universe, of the order 10^{26} meters; and physically-meaningful minimum value of wavelength is Compton-wavelength corresponding to total mass of the universe; i.e. $\lambda_{min} = h / M_0 c$. Now, it was noticed earlier [2] that the product $M_0 (h H_0 / c^2) = m_{Pl}^2$, where m_{Pl} is Planck's unit of mass = $[h c / G]^{1/2}$. Also, the product of gravitational radius ($G m / c^2$) and Compton wavelength ($h/m c$) of every particle of mass m is always equal to Planck's length squared. So the product of gravitational-radius of the universe and Compton-wavelength of total-mass of the universe, $R_0 (h / M_0 c)$, = l_{Pl}^2, where l_{Pl} is Planck's unit of length = $[h G / c^3]^{1/2}$.

Moreover, gravitational radius of the universe (R_0) is equal to Compton wavelength corresponding to the mass ($h\ H_0\ /\ c^2$), we can call it mass of the 'Hubble-tron' and:

Compton-wavelength $h\ /\ M_0\ c$ = the gravitational-radius of the Hubble-tron, $G\ (h\ H_0\ /\ c^2)\ /\ c^2$.

In astrophysics, Hubble's constant H_0 is the 'experimentally measured quantity', whereas R_0 and M_0 are mathematically-derived quantities based on expanding model of the universe, and the mass required for its closure. If the model is not correct, then they may have no meaning, other than the maximum values of wavelength $\lambda_{\max} = R_0$ and frequency $f_{max} = (M_0\ c^2/\ h)$. The model-independent relations of H_0 with the other well-established physical-constants are:

$G\ m_e\ m_p\ /\ (h\ /\ m_e\ c) \sim h\ H_0$ ……………………………………….(2)

$G\ m_p\ /\ (h\ /\ m_p\ c)^2 \sim H_0\ c$ ……………………………………….(3)

And $h\ H_0\ /\ m_e\ c^2 \sim (G\ m_e\ m_p)\ /\ e^2$ ……………………………………(4)

Not only that, but also:

The accelerations $G\ M\ /\ R^2$ at the surface of the electron, the proton, the nucleus-of-atom, the globular-clusters, the spiral galaxies, the galactic-clusters and the whole universe too are of the same order of magnitude as $H_0\ c$! The 'critical-acceleration of the Modified Newtonian Dynamics (MOND) is also equal to $H_0\ c$! [3]

Numerically, the quantity ($H_0\ c$) = 6.87 x 10^{-10} meter/second^2, and the decelerations experienced by the Pioneer 10, 11, … space-probes were also of the same order of magnitude 10^{-10} meter/second^2 as follows: [4-5]:

For Pioneer-10, a = (8.09 ±0.2) x 10^{-10} meter/sec^{2,}

For Pioneer-11, a = (8.56 ±0.15) x 10^{-10} meter/sec^2,

For Ulysses, a = (12 ±3) x 10^{-10} meter/sec^2,

For Galileo, a = (8.0 ±3) x 10^{-10} meter/sec^2, and

The values of deceleration experienced by the space-probes are slightly higher, because: when the inter-galactic photon enters our milky-way galaxy, it experiences certain amount of gravitational blue-shift. If we could launch Hubble-

like telescope out-side our milky-way galaxy, then the value of $H_0\ c$ may match perfectly with the value of space-probes. Values of decelerations of the space-probes may have been partly affected by thermal radiation or gas-leaks too!

The 'cosmological red-shift' too, can be viewed as the 'deceleration' experienced by the photons [6] as follows:

The linear part of the cosmological red shift is:

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

So the loss in energy of the photon:

$(h f_0 - hf) = (h f / c^2) (H_0\ c) D$ ……………………………..………(5)

That is, the loss in energy of the photon is equal to its mass ($h f / c^2$) times the acceleration ($H_0\ c$) times the distance D traveled by it. This writer has proposed many possible mechanisms for deceleration of the photon, currently posted at the pre-print-server site viXra. As soon as any one of them proves to be correct, the Big-Bang Theory will prove to be incorrect; i.e. the universe may not be expanding.

References

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