On the Origin of Hubble's Constant

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Abstract:

Cosmology is primarily based on the measured value of Hubble's constant. Though its value is still being refined, the currently available value shows interesting relations with the other physical constants, as derived here. These relations can be helpful for: (i) arriving at theoretical value of Hubble's constant, and (ii) for understanding correct mechanism behind the cosmological red-shift. The relationship of Hubble's constant H_0 with the other constants derived here are: $(h\, H_0 / m_e\, c^2) = [\, (G\, m_e\, m_p) / h\, c\,] = [\, \lambda_C / R_0\,] = [\, (G\, m_p / c^2) / \lambda_C\,] = [\, m_p / M_0\,]^{1/2}$; here: h is Planck's constant, c the speed of light, and λ_C is Compton-wavelength of the electron. These relations suggest that either the cosmological red-shift is based on gravity, or gravity is due to the cosmological red-shift-effect on the photons exchanged between the particles.

Introduction:

While the Big Bang Model of cosmology is the most popular among majority cosmologists, some physicists have raised doubts about the very expansion of space [1]; and there are some unresolved problems like dark-energy. Therefore it is good to keep our mind open for some alternative possibilities. The relations derived here can be useful for both: the expansionist cosmologists as well, as for the minority skeptics'.

The Derivations:

The derivations presented here are based on the following well-accepted relations:

$H_0\, R_0 = c$ …….(1)

Where H_0 is Hubble's constant, and R_0 is radius of the universe at which the recessional-velocity attains the speed of light.

$G\, M_0\, M_0 / R_0 = M_0\, c^2$ ……..(2)

Where M_0 is mass of the universe required for the 'closer-density'.

And $\lambda_C = h / m_e\, c^2$ …….(3)

Where h is Planck's constant.

Since: $G\, M_0\, M_0 / R_0 = M_0\, c^2$,

i.e. $G M_0 m_e / R_0 = m_e c^2$,

i.e. $[G M_0 H_0 m_e / c] = m_e c^2$,

i.e. $G M_0 H_0 = c^3$ ……(4)

Now: based on the expressions (1) and (3):

$(H_0 h / m_e c^2) = (\lambda_C / R_0)$ ……(5)

The gravitational coupling constant is:

$G m_e m_p / h c$

Dividing both numerator and denominator by $G m_p / c^2$:

$[G m_e m_p / h c] = (m_e c^2) (G m_p / h c^3)$

$[G m_e m_p / h c] = (m_e c^2) (G m_p / h G M_0 H_0)$

And making use of the expression-4:

$[G m_e m_p / h c] = (m_e c^2 / h H_0) (m_p / M_0)$

i.e. $[G m_e m_p / h c] = (R_0 / \lambda_C) (m_p / M_0)$

i.e. $[G m_e m_p / h c] [\lambda_C / R_0] = (m_p / M_0)$ ……(6)

The expression-6 is the well-known Large-Number-Ratio first noticed as an interesting coincidence by P.A.M. Dirac and Arther Eddington; whereas here we have derived it based on the well accepted. This derivation leads us to a conclusion that the Large-Number-Coincidence is not a coincidence, rather these large-numbers are theoretically-derivable relations. These relations suggest that the Hubble's constant is related to the gravitational coupling constant.