Formula for the CNB Temperature in $R_h = ct$ cosmolgy

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April 1, 2024

Abstract

We are suggesting a temperature formula for the CNB temperature, first somewhat speculatively, then we tell how to derive it from the Haug-Spavieri universe and the Haug extremal universe. Further investigation is clearly needed to find out if there is anything to it.

1 CMB and CNB temperature

The CMB temperature is approximately 2.72K. Tatum et. al [1] suggested in 2015 the CMB temperature for $R_h = ct$ cosmology is given by:

$$T_{cmb} = \frac{\hbar c^3}{k_b 8\pi G\sqrt{M_{c,t} m_p}} = \frac{\hbar c}{k_b 4\pi\sqrt{R_t 2 l_p}} \tag{1}$$

Where $R_t = ct$, l_p is the Planck length, and k_b is the Boltzmann constant.

Haug and Wojnow [2, 3] have demonstrated that this formula can be derived from the Stefan-Boltzmann law, and there is considerable theory developed in relation to it today. See, for example, [4].

The Cosmic Neutrino Background temperature is assumed to be approximately 1.95K. Here, we will first speculatively point out that we likely have (in the next section we will point out how it can be derived):

$$T_{\text{cnb}} = \frac{\hbar c^3}{k_b 8\pi G\sqrt{M_{c,t} 2 m_p}} = \frac{\hbar c}{k_b 8\pi\sqrt{R_t l_p}} \tag{2}$$

where $M_{c,t} = \frac{c^2 R_t}{2G}$ and $R_t = ct$. For the current CNB temperature this would give:

$$T_{\text{cnb}} = \frac{\hbar c^3}{k_b 8\pi G\sqrt{M_c 2 m_p}} = \frac{\hbar c}{k_b 8\pi\sqrt{R_h l_p}} \approx 1.93K \tag{3}$$

where R_h is the current Hubble radius: $R_h = \frac{c}{H_0}$ and M_c is the current critical Friedmann mass $M_c = \frac{c^2 R_h}{2G}$ that for earlier cosmic epochs naturally is $M_{c,t} = \frac{c^2 R_t}{2G}$.

This formula is a ad hoc modifying the CMB temperature formula of Tatum et. al., but as we soon will see we can also derive it.

Based in this we also have :

$$\frac{T_{cnb}}{T_{cmb}} = \frac{\frac{\hbar c}{k_b 8\pi\sqrt{R_h l_p}}}{\frac{\hbar c}{k_b 4\pi\sqrt{R_h 2 l_p}}} = \frac{1}{\sqrt{2}} \approx 0.70711 \tag{4}$$

While in standard theory one have :

$$\frac{T_{cnb}}{T_{cmb}} = \left(\frac{4}{11}\right)^{\frac{1}{3}} \approx 0.714 \tag{5}$$

2 The CNB Temperature coming out from the Haug-Spavieri metric universal mass-energy

The formula above can actually be derived if we link it to the Haug-Spavieri [5] metric (but also from the extremal solutions of Reissner-Nordstrom, Kerr and Kerr-Newman can be used, see [6]). The Haug-Spavieri metric leads to a total mass-energy in the observable universe as given by :

$$M_u = \frac{c^2 R_h}{2G} + \frac{c^3 \Lambda R_h^2}{6G} \tag{6}$$

The first part, $\frac{c^2 R_h}{2G}$, is identical to the critical Friedmann mass. The second part is linked to relativistic gravitational energy and the cosmological constant, which has an exact value of $\Lambda = 3\left(\frac{H_t}{c}\right)^2 = \frac{3}{R_h^2}$. This last part of the total mass is relativistic gravitational energy, which can also be considered dark energy. This means that, similar to Haug and Wojnow's derivation of the CMB temperature from the Stefan-Boltzmann law, we can derive from scratch the formula we speculated on above, but now it is given as:

$$T_{\text{cnb}} = \frac{\hbar c^3}{k_b 8\pi G\sqrt{M_u m_p}} = \frac{\hbar c}{k_b 8\pi\sqrt{R_h l_p}} \approx 1.93K \tag{7}$$

The difference is now M_u is the Haug-Spavieri universe mass and not the critical Friedmann universe mass $M_u = 2M_c = \frac{c^2 R_t}{G}$, where $R_t = ct$. That is identical to the critical Friedmann mass + 50% dark energy, which is nothing more than relativistic gravitational energy interacting with matter. The Haug-Spavieri universe is consistent with $R_h = ct$ and also the Haug extremal universe. This naturally mean the formula is valid for any cosmic epoch. However further investigation is warranted.

References

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