Stochastic Cosmology and the Hubble Constant

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Abstract

We recently pointed out that the numerical value of the vacuum energy parameter derived via the Friedmann model may be reasonably approximated within the framework of Stochastic Cosmology. This brief note shows that the Hubble constant prediction of Stochastic Cosmology also falls in line with observational data.

Key words: stochastic cosmology, vacuum energy parameter, cosmological constant, Hubble constant.

It was argued in [1] that the average vacuum energy density evaluated using Stochastic Cosmology is approximated by

$$\langle \rho_\Lambda \rangle = \frac{9}{2} H^2 M_G^2 \qquad (1)$$

in which H is the Hubble constant and M_G the natural scale of the gravitational interaction in empty space,

$$M_G^2 = (16\pi G_N)^{-1} \tag{2}$$

Comparing (1) to the standard expression of vacuum energy density in relativistic cosmology yields

$$\langle \rho_\Lambda \rangle = \rho_{s,\Lambda} = \frac{\Lambda}{8\pi G_N} \Rightarrow \Lambda = \frac{9}{4} H^2 \tag{3}$$

or,

$$\boxed{\sqrt{\Lambda} = \frac{3}{2} H} \tag{4}$$

Relation (4) is consistent with the estimated values of cosmological and Hubble constants expressed in natural units [2-3], e.g.

$$\Lambda \approx 5.06 \times 10^{-84} GeV^2 \tag{5a}$$

$$H \approx 10^{-42} GeV \tag{5b}$$

References

1. Available at the following sites:

https://www.researchgate.net/publication/350640840_Stochastic_Cosmology_and_the_Vacuum_Energy_Parameter

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