On the Cold Big Bang Cosmology and the Flatness Problem

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In my papers [3] and [4], I obtain a Cold Big Bang Cosmology, fitting the cosmological data, with an absolute zero primordial temperature, a natural cutoff for the cosmological data to a vanishingly small entropy at a singular microstate of a comoving domain of the cosmological fluid. Now, in this brief paper, we show the energy density of the $t$-sliced universe must actually be the critical one, following as consequence of the solution in [3] and [4].

1 Explaining the observed critical energy density for the cosmological substratum

The proof is straightforward. Recalling the $t$-sliced spherical shell defined in [4], we proved its energy at the instant $t$ of the cosmological time is given by:

$$N_t \delta E = E^+(t) = \frac{E^+_0}{\sqrt{1 - \dot{R}^2/c^2}},$$

being the Eq. (6) in [4] and the Eqs. (56) and (59) in [3]. From the Eq. (36) in [3], the Eq. (1) is simply rewritten:

$$E^+=\frac{c^4R}{2G},$$

from which the energy density of the $t$-sliced spherical shell pertaining to its $t$-sliced hypersurface of simultaneity, being full of its $t$-simultaneous cosmological points of the substratum, turns out to be given by:

$$\rho_t = \frac{c^4R}{2G} \frac{3}{4\pi R^3} = \frac{3c^4}{8\pi G R^2} \frac{1}{R^2}.$$  (3)

Now, once defined the Hubble parameter for the spherical shell of the $t$-sliced hypersurface, centered at its comoving origin, namely $H_t$:

$$H_t = \frac{\dot{R}}{R},$$

one obtains the energy density of the $t$-sliced spherical shell pertaining to its $t$-sliced hypersurface of simultaneity from the Eqs. (3) and (4):

$$\rho_t = \frac{3c^2H_t^2}{8\pi G} \frac{c^2}{R^2}.\quad (5)$$

Now, Eq. (35) in [3] shows $\dot{R}$ very rapidly reaches $c$. Hence, the energy density $\rho_t$ of the $t$-sliced spherical shell pertaining to its $t$-sliced hypersurface of simultaneity actually is the very critical energy, viz.:

$$\rho_t \rightarrow \rho_{crit} = \frac{3c^2H_t^2}{8\pi G}.\quad (6)$$

very rapidly, and it will continue being the critical energy density $\rho_{crit}$ forever*. The time domain within which $\rho_t$ deviates from the critical is $t \approx 0$, at which it reads:

$$\rho_0 = \frac{3c^7}{16\pi G^2 h} \approx 10^{111} J m^{-3},$$

provided the energy density $\rho_t$ of the $t$-sliced spherical shell being given by the Eq. (3) and with the $R_0 = \sqrt{2Gh/c^3}$ obtained in [3]. The Hubble parameter vanishes at $t = 0$ in our model†.

Conclusion

We conclude the cosmological model obtained in [3] and [4] provides the critical energy density for the $t$-sliced spherical shell pertaining to its $t$-sliced hypersurface of simultaneity of the cosmological substratum.

Acknowledgments

A.V.D.B.A is grateful to Y.H.V.H and CNPq for financial support.

Submitted on June 21, 2011 / Accepted on June 21, 2011

References


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*It will continue being given by the Eq. (6), but its value tends to vanish, as one easily infers from the Eq. (3). See [3] and [4].
†See [3] and [4].