3.5 Some cosmological models with inflation, acceleration and deceleration

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ABSTRACT

Since $1997^{1,2}$, it is known that universe is expanding with an acceleration. Many ideas have been employed to explain this phenomenon. Use of a variable cosmological parameter was proposed by Hemantha and de Silva (2003) & (2004) [3,4].

In 2007, the present authors [5] proposed a family of cosmological models given by $R = b_3(1 - \cos^3 \omega t)$. However, these models fail to explain the inflation of the universe near $t = 0$. In this communication, we propose a solution that not only explains inflation near $t = 0$, deceleration of the universe at the beginning but the onset of acceleration and a second phase of deceleration, before the universe commences contraction. Taking the age of the universe [6] to be 13.7 billion years and the ratio of the dark energy to matter as $\dfrac{7}{3}$ at present, we find that ω has to lie between $4.16 \times 10^{-18} \, rad.s^{-1}$ and $5.32 \times 10^{-18} \, rad.s^{-1}$, if ρ is to be positive for all values of t. If we take the particular value $\omega = 5.32 \times 10^{-18} \, rad.s^{-1}$, we find that, the onset of acceleration took place at a redshift 1.26 and that the present density of the universe is $1.22 \times 10^{-29} \, g.cm^{-3}$, agreeing with observations.

When ω takes this particular value R and ρ take the forms,
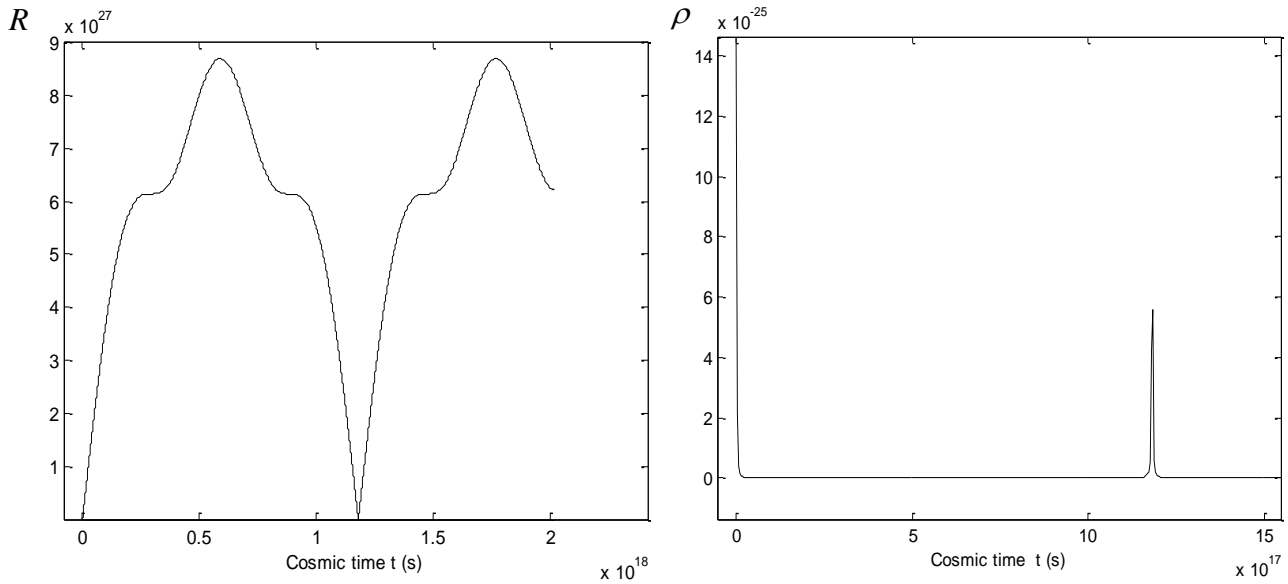
References:

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2. Perlmutter S. et. al., 1998, Nature, 391, 51.

3. Hemantha M. D. P., de Silva Nalin, 2003 , Annual Research Symposium, University of Kelaniya, Kelaniya, 2003, 61.

4. Hemantha M. D. P., de Silva Nalin , 2004 , Annual Research Symposium, University of Kelaniya, Kelaniya, 2004, 55.

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