Towards an Exact Solution of FRW Type of Spacetime With a Generalized Chaplygin Gas - An Alternative Approach

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Abstract. The evolution of a universe modelled by a generalized Chaplygin gas with an equation of state is studied for a Robertson Walker type of spacetime. The resulting field equations are highly nonlinear in the scale factor which is a key equation of this work. Using this equation previous authors [1] have explained dust dominated and accelerating universe at the two extreme cases. But to our knowledge we have not as yet come across any explicit solution of scale factor as function of time. To avoid such incompleteness, we have taken the first order approximation of the key equation and subsequently have found out the time explicit exact solutions of scale factor. This solution approaches CDM model for large scale factor and the desirable feature of acceleration flip occurs in this case. We have also made a detailed analysis of flip time both analytically and graphically. Further the whole situation is studied in the backdrop of well-known Raychaudhury equation [2] and a comparison made with the previous results.

References:

1. M. C. Bento, O. Bertolami and A. A. Sen, 2003 Phys.Rev. D67, 063003.
2. A. K. Raychaudhuri, 1955 Phys. Rev. 98, 1123.