Astrophys Space Sci (2012) 338:309–311
DOI 10.1007/s10509-011-0872-x

ORIGINAL ARTICLE

Axially symmetric radiating cosmological model in a self-creation cosmology

D.R.K. Reddy · R.L. Naidu

Received: 23 August 2011 / Accepted: 20 September 2011 / Published online: 27 January 2012

Abstract An axially symmetric space time is considered in the presence of a perfect fluid source in Barbers (Gen. Relativ. Gravit. 14, 117, 1982) second self creation theory of gravitation. An exact radiating cosmological model is presented using a relation between the metric potentials. Some physical and kinematical properties of the model are also discussed.

Keywords Axially symmetric · Self-creation cosmology · Radiating model

1 Introduction

It is well known that in recent years there has been a considerable interest in alternative theories of gravitation which are viable alternatives to general relativity. Brans and Dicke (1961) formulated a scalar tensor theory of gravitation which incorporates Machs-principle in a relativistic frame work. Barber (1982) produced two continuous creation theories. The first is a modification of Brans Dicke theory and the second is an adoption of general relativity to include continuous creation of matter and is within the limits of observation. These modified theories create the universe out of self contained gravitational and matter fields.

D.R.K. Reddy
Department of Science and Humanities, M.V.G.R. College of Engineering, Vizianagaram, India
e-mail: reddy_einstein@yahoo.com

R.L. Naidu (✉)
Department of Basic Science and Humanities, GMR Institute of Technology, Rajam, India
e-mail: naidurl@rediffmail.com

Several authors have investigated various cosmological models in Barbers second self creation theory Pimentel (1985), Soleng (1987), Singh (1984), Reddy (1987a, 1987b), Reddy et al. (1987), Reddy and Venkateswarlu (1989), Shanti and Rao (1991), Reddy and Naidu (2008), Pradhan and Vishwakarma (2002) are some of the authors who have discussed various cosmological models in second self creation theory. However axially symmetric cosmological models in the presence of radiating perfect fluid have not been investigated in second self creation theory proposed by Barber. Radiating cosmological models are also important to discuss the early stages of evolution of the universe.

In this chapter we obtain axially symmetric radiating cosmological model in the presence of perfect fluid source.

2 Metric and field equations

We consider the uniform, anisotropic and axially symmetric (Bhattacharya and Karade 1993)

$$ds^2 = dt^2 - A^2(t)[d\chi^2 + f^2(\chi)d\phi^2] - B^2(t)dz^2 \qquad (2.1)$$

with the convention $x^1 = \chi$, $x^2 = \phi$, $x^3 = z$, and $x^4 = t$ and A and B are functions of the proper time t alone while f is a function of the coordinate χ alone.

The non-vanishing components of Einstein tensor for the space time (2.1) are

$$G_1^1 = G_2^2 = -\frac{A_{44}}{A} - \frac{B_{44}}{B} - \frac{A_4 B_4}{AB}$$

$$G_3^3 = -2\frac{A_{44}}{A} - \frac{A_4^2}{A^2} + \frac{1}{A^2}\frac{f_{11}}{f}$$

$$G_4^4 = -2\frac{A_4 B_4}{AB} - \frac{A_4^2}{A^2} + \frac{1}{A^2}\frac{f_{11}}{f}$$