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ORIGINAL ARTICLE

Bianchi type-V cosmological model with purely magnetic solution

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Abstract In the present paper we study some new aspects of the Bianchi type-V space time. The Electric and Magnetic parts of Weyl tensors are calculated in terms of tilted congruence and discussed the purely magnetic Weyl tensor. Einstein field equations for purely magnetic space time are obtained and solution of such field equations called purely magnetic solution. To get deterministic solutions of the field equations we consider a new law of variation of average scale factor which yields time dependent deceleration parameter. Certain physical and geometrical properties of the model are also discussed.

Keywords Bianchi type-V cosmological model · Purely magnetic space time

1 Introduction

The present day observation indicate that the universe at large scale is homogeneous-isotropic and accelerating phase of universe (detected experimentally, Gasperini et al. 2003). In fact, there are theoretical arguments from the recent experimental data which support the existence of an anisotropic phase approaching to isotropic phase leading to consider the model of universe with anisotropic background. Cosmological models which are spatially homogeneous and anisotropic play significant roles in the description of the universe at its early stage of evolution. Bianchi type-V model having richer structure than other anisotropic space time and are interesting to study. Bianchi V space time has attracted attention of researcher from many years (Ram et al. 2009; Singh et al. 2008; Singh 2009; Bali and Singh 2005; Rao et al. 2007 and references therein); its interest may be understood by recalling that amongst different models Bianchi V universes are the natural generalization of the open FRW models which eventually become isotropic. These models are favoured by the available evidences for low density universe. A number of authors such as Maharaj and Beesham (1988), Wainwright et al. (1979), Farnswerth (1967), Collins (1974), Maartens and Nel (1978), Beesham (1986), Ram (1990), Camci et al. (2001), Roy and Singh (1983, 1985) and Pradhan and Rai (2004) have studied Bianchi type-V model in the different physical contexts. Bali and Meena (2004) and Pradhan and Srivastava (2007) have studied the Bianchi type-V space time in terms of tilted observer.

In the present work our purpose is to study some new aspects of Bianchi type-V space time which have not been considered until now, and which may shed some light on the nature of such a physically meaningful space time.

The exact solution of the Einstein field equations in which there exists an observer with four velocity vector u^{α} measuring $E_{\alpha\beta} = C_{\alpha\gamma\beta\sigma}u^{\gamma}u^{\sigma}$ and $H_{\alpha\beta} = C^{*}_{\alpha\gamma\beta\sigma}u^{\gamma}u^{\sigma}$, the electric and magnetic parts of Weyl tensor respectively (Ahsan 1999; Bel 2000; Maartens et al. 1993; Bruni et al. 1995; McIntosh et al. 1994; Bonnor 1995; Dunsby et al. 1997; Maartens and Basset 1998; Van den Bergh 2003; Ferrando and Saez 2003). The electric ($E_{\alpha\beta}$) and magnetic ($H_{\alpha\beta}$) Weyl tensors are symmetric, trace free and spatial ($E_{\alpha\beta}u^{\beta} = 0$, $H_{\alpha\beta}u^{\beta} = 0$). The solutions satisfying $E_{\alpha\beta} = 0$, $H_{\alpha\beta} \neq 0$ (and $E_{\alpha\beta} \neq 0$, $H_{\alpha\beta} = 0$) is known as purely magnetic solution (purely electric solution) (Ahsan 1999; McIntosh et al. 1994; Lozanovski and Aarons 1999).

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