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ORIGINAL ARTICLE

# Dark energy models with anisotropic fluid in Bianchi Type-$VI_0$ space-time with time dependent deceleration parameter

**Anirudh Pradhan · Rekha Jaiswal · Kanti Jotania · Rajeev Kumar Khare**

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**Abstract** We present two dark energy (DE) models with an anisotropic fluid in Bianchi type-$VI_0$ space-time by considering time dependent deceleration parameter (DP). The equation of state (EoS) for dark energy $\omega$ is found to be time dependent and its existing range for derived models is in good agreement with the recent observations. Under the suitable condition, the anisotropic models approach to isotropic scenario. We also find that during the evolution of the universe, the EoS parameter for DE changes from $\omega > -1$ to $\omega = -1$ in first model whereas from $\omega > -1$ to $\omega < -1$ in second model which is consistent with recent observations. The cosmological constant $\Lambda$ is found to be a positive decreasing function of time and it approaches a small positive value at late time (i.e. the present epoch) which is corroborated by results from recent type Ia supernovae observations. The cosmic jerk parameter in our derived models is also found to be in good agreement with the recent data of astrophysical observations. The physical and geometric aspects of both the models are also discussed in detail.

**Keywords** Bianchi type-$VI_0$ universe · Dark energy · Variable EoS parameter

A. Pradhan (✉) · R. Jaiswal
Department of Mathematics, Hindu Post-Graduate College, Zamania 232 331, Ghazipur, India
e-mail: pradhan@iucaa.ernet.in

A. Pradhan
e-mail: pradhan.anirudh@gmail.com

R. Jaiswal
e-mail: rekhajaiswal68@yahoo.com

K. Jotania
Department of Physics, Faculty of Science, The M. S. University of Baroda, Vadodara 390 002, India
e-mail: kanti@iucaa.ernet.in

K. Jotania
e-mail: kanti.jotania@gmail.com

R.K. Khare
Department of Mathematics, Sam Higginbottom Institute of Agriculture, Technology & Sciences (Formaly Allahabad Agricultural Institute), Deemed University, Allahabad 211 007, India
e-mail: drrajeevkhare@gmail.com

## 1 Introduction

The concept of dark energy was first invoked in the late 1990s by studying the brightness of distinct supernovas-exploding stars. In 1998, published observations of Type Ia supernovae by the High-z Supernova Search Team (Riess et al. 1998) followed in 1999 by Supernova Cosmology Project (Perlmutter et al. 1999) suggested that the expansion of the universe is accelerating. Recent observations of SNe Ia of high confidence level (Tonry et al. 2003; Riess et al. 2004; Clocchiatti et al. 2006) have further confirmed this. In addition, measurements of the cosmic microwave background (CMB) anisotropies (Bennett et al. 2003; de Bernardis et al. 2000; Hanany et al. 2000), large scale structure (LSS) (Tegmark et al. 2004a, 2004b; Spergel et al. 2003), the sloan digital sky survey (SDSS) (Seljak et al. 2005; Adelman-McCarthy et al. 2006), the Wilkinson microwave anisotropy probe (WMAP) (Perlmutter et al. 2003) and the Chandra x-ray observatory (Allen et al. 2004) strongly indicate that our universe is dominated by a component with negative pressure, dubbed as dark energy, which constitutes with $\simeq 3/4$ of the critical density. The cosmic acceleration is realized with negative pressure and positive energy density that violate the strong energy condition. This violation gives a reverse gravitational effect. Due to this effect, the Universe