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ORIGINAL ARTICLE

Anisotropic bulk viscous cosmological models in a modified gravity

D.R.K. Reddy · R. Bhuvana Vijaya · T. Vidya Sagar · R.L. Naidu

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Abstract A spatially homogeneous Bianchi type-VI_0 space-time is considered in the frame work of $f(R,T)$ gravity proposed by Harko et al. (Phys. Rev. D 84:024020, 2011) when the source for energy momentum tensor is a bulk viscous fluid containing one dimensional cosmic strings. Exact solutions of the field equations are obtained both in the absence and in the presence of cosmic strings under some specific plausible physical conditions. Some physical and kinematical properties of the model are, also, studied.

Keywords $f(R,T)$ gravity · Bulk viscous model cosmic strings · Bianchi type-VI_0 model

1 Introduction

Several astronomical observations indicate that the observable universe is undergoing a phase of accelerated expansion (Reiss et al. 1998; Perlmutter et al. 1998, 2003; de Bernardis et al. 2000) and this expansion of the universe is driven by an exotic energy with large negative pressure which is known as dark energy. In spite of the all observational evidence, dark energy is still a challenging problem in theoretical physics. The data indicates that the universe is spatially flat and is dominated by 76 % dark energy, 24 % by other matter (20 % dark matter and 4 % other cosmic matter). Thus dark energy has become important in modern cosmology and there has been a considerable interest in cosmological models with dark energy. A nice review of dark energy and dark energy models is presented by Mishra and Sahoo (2013). There are two major approaches to address this problem of cosmic acceleration either by introducing a dark energy component in the universe and study its dynamics or by interpreting as a failure of general relativity and consider modifying Einstein's theory of gravitation termed as 'modified gravity approach'. Among the various modifications of Einstein's theory $f(R)$ gravity (Caroll et al. 2004) is treated most suitable due to cosmologically important $f(R)$ models. In this theory, a more general action is chosen in which standard Einstein–Hilbert action is replaced by an arbitrary function of Ricci Scalar R, i.e. $f(R)$ so that this modified theory may explain the late time acceleration of the universe. It also describes the transition phase of the universe from deceleration to acceleration (Nojiri and Odintsov 2007). Several aspects of $f(R)$ gravity have been investigated by Capozziello et al. (2007, 2008), Multamaki and Vilja (2006, 2007), Sharif and Zubair (2010), Azadi et al. (2008), Nojiri and Odintsov (2003, 2004, 2007) and Chiba et al. (2007). A comprehensive review of $f(R)$ gravity has been given by Copeland et al. (2006).

Recently, a further generalization of $f(R)$ gravity theory has been proposed by Harko et al. (2011). In this, the gravitational Lagrangian is given by an arbitrary function of the Ricci Scalar R and of the trace T of the stress energy tensor T_{ij}. The field equations of $f(R,T)$ gravity are derived from Hilbert–Einstein type variational principle by taking the ac-

D.R.K. Reddy (✉)
Department of Science and Humanities, M.V.G.R College of Engineering, Vizainagaram, Andhra Pradesh, India
e-mail: reddy_einstein@yahoo.com

R. Bhuvana Vijaya
Dept. of Mathematics, JNTU, Anantapur, A.P, India

T. Vidya Sagar
Department of Science and Humanities, Miracle Educational Society Group of Institutions Vizainagaram, Vizainagaram, Andhra Pradesh, India

R.L. Naidu
GMRIT, Rajam, India

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