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ORIGINAL ARTICLE

FRW and Bianchi type I cosmology of f-essence

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Abstract F-essence is a generalization of the usual Dirac model with the nonstandard kinetic term. In this paper, we introduce a new model of spinor cosmology containing both Ricci scalar and the non minimally coupled spinor fields in its action. We have investigated the cosmology with both isotropy and anisotropy, where the equations of motion of FRW and Bianchi type-I spacetimes have been derived and solved numerically. Finally the quantization of these models through Wheeler-De Witt (WD) wave function has been discussed.

Keywords Spinor cosmology · Spinor fields · FRW model · Bianchi Type I model

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1 Introduction

Astrophysical data of supernovae of type Ia indicate that we live in an accelerated expansion era of the Universe (Perlmutter 1999; Riess 1998). There are two major theoretical explanations for this phenomena: the first category is the fluid model in which we keep the Einstein gravity as a dominant theory and introduce a fluid in the right hand side of the Einstein field equation and then investigate the cosmological evolution of the model (Copeland et al. 2006; Amendola 2000, paper II). Another approach which has been investigated in recent years is the geometrical one in which we search for generalized models of the gravity which can deduce the accelerated expansion of the Universe (Elizalde et al. 2004, paper I). Some examples of later model is $f(R)$ gravity (Nojiri and Odintsov 2003, 2007, 2011; Cognola et al. 2008; Azadi et al. 2008; Elizalde et al. 2004, 2010, 2011, paper III, Jamil 2011a, 2011b, paper I; Momeni and Gholizade 2009; Raza et al. 2011, paper I) in which the only dynamical sector of action is a function of the Ricci scalar. Here the non-linear terms of the curvature can be regarded as an alternative for the accelerated expansion of the Universe. Another class of models are the $f(R,G)$ models, where both curvature and Gauss-Bonnet terms as the dynamical quantities (Elizalde et al. 2004, 2010, 2011, paper II; Bamba et al. 2010; De Felice et al. 2010). Another interesting approach is the $f(T)$ gravity where T is the torsion. Although it has no curvature, the space-time manifold has time evolution, and the dynamics has been caused by the Torsion only (Hayashi and Nakano 1967; Hayashi 1973, 1977; Hayashi and Shirafuji 1979; Wu and Yu 2010; 2011; Pellegrini and Plebanski 1963; Yerzhanov et al. 2010; Chen et al. 2011; Bengochea 2011; Li et al. 2011; Wei et al. 2011). Since its equations of motions are lower order, working with it is easier, also