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ORIGINAL ARTICLE

Generalized teleparallel gravity via some scalar field dark energy models

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Abstract We consider generalized teleparallel gravity in the flat FRW universe with a viable power-law $f(T)$ model. We construct its equation of state and deceleration parameters which give accelerated expansion of the universe in quintessence era for the obtained scale factor. Further, we develop correspondence of $f(T)$ model with scalar field models such as, quintessence, tachyon, K-essence and dilaton. The dynamics of scalar field as well as scalar potential of these models indicate the expansion of the universe with acceleration in the $f(T)$ gravity scenario.

Keywords $f(T)$ gravity · Scalar field models · Dark energy · Dark matter

1 Introduction

There are growing evidences of dark energy (DE) responsible for the present expanding universe with an acceleration over the last few years. Its confirmation is made by type Ia supernovae (Perlmutter et al. 1999), galaxy redshift surveys (Fedeli et al. 2009), cosmic microwave background radiation (CMBR) data (Caldwell and Doran 2004; Huang et al. 2006a, 2006b; Keum 2007) and large scale structure (Koivisto and Mota 2006; Daniel 2008). The standard cosmology has been remarkably successful but there remain some serious unresolved issues including the search for the best DE candidate. The origin and nature of DE is still unknown except some particular ranges of the equation of state (EoS) parameter ω. In the absence of any solid argument in favor of DE candidate, a variety of models have been investigated.

Scalar field models are one of the proposed scenarios for DE. The mechanism of these models suggests that a scalar field (ϕ) provides energy with negative pressure, leading to decrease a proper potential of the field. A great number of scalar field DE models have been studied so far, including quintessence with dominating potential (Huang et al. 2006a, 2006b), K-essence with non-standard kinetic term (Armendariz-Picon et al. 2000, 2001), tachyon having negative squared mass (Sen 2002; Padmanabhan 2002), phantom keeping negative energy (Nojiri and Odintsov 2003a, 2003b), ghost condensate with no potential (Arkani-Hamed et al. 2004; Piazza and Tsujikawa 2004), quintom (Guo et al. 2005; Zhang 2005; Setare 2006) and dilaton with high energy particles (Copeland et al. 2006). There are many attempts to reconstruct potential and scalar fields by establishing a connection between different DE models with these scalar field models.

Setare (2007a, 2007b, 2007c, 2007d, 2008) studied the correspondence of HDE model with Chaplygin gas, interacting generalized Chaplygin gas, interacting phantom scalar field and tachyon scalar field model in general relativity. Ebrahimi and Sheykhi (2011) reconstructed the power-law entropy-corrected HDE by correspondence with the above mentioned scalar fields in non-flat evolving universe. Sharif and Jawad (2012) have investigated interacting HDE with new IR cutoff to develop correspondence with the scalar field models and discussed the accelerated expansion of the universe. Granda and Oliveros (2009) studied the correspondence between the quintessence, tachyon, K-essence and dilaton energy density with HDE density by taking event

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