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ORIGINAL ARTICLE

Cosmic acceleration and phantom crossing in $f(T)$-gravity

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Abstract In this paper, we propose two new models in $f(T)$ gravity to realize universe acceleration and phantom crossing due to dark torsion in the formalism. The model parameters are constrained and the observational test are discussed. The best fit results favors an accelerating universe with possible phantom crossing in the near past or future followed respectively by matter and radiation dominated era.

Keywords $f(T)$-gravity · Teleparallelism · Observational test · Distance modulus

1 Introduction

In recent cosmological observations such as the Type Ia Supernova (SNe Ia) (Riess et al. 1998; Perlmutter et al. 1999), the cosmic microwave background radiation (Spergel et al. 2003, 2007) and the large scale structure (Tegmark et al. 2004; Eisenstein et al. 2005), et al., we found that in near past, the universe is undergoing an accelerating expansion phase. This surprising behavior represents one of the most complex issues in today cosmology. So far, the so called "dark energy" (DE) in our universe, as an exotic energy component with negative pressure dominating the universe is known as the most prominent candidate driving universe to an accelerating expansion phase.

The simple ΛCDM model with a constant equation of state (EoS) is known as the simplest model in general agreement with the current experimental data. However, the model suffers from "cosmological constant problem" (Carroll 2001; Copeland et al. 2006). In addition, recent observation reveals that the model may endure from an age problem (Yang 2010). An alternative approach thus seems reasonable to find and investigate for the current acceleration of the universe. Observational probes support a small deviations in the EoS parameter by crossing phantum divide line from above to below in the near past. This therefore requires a dynamical description of the parameter (Feng et al. 2005). The accelerating universe may be interpreted as a failure in our understanding to the gravitational law. Thus we may require an alternative to standard theory of gravity.

In last few years, a variety of cosmological models, such as, quintessence (Caldwell et al. 1998), k-essence (Armendariz-Picon et al. 2001), tachyon (Padmanabhan 2002; Sen 2005), phantom (Caldwell 2002), quintom (Feng et al. 2005; Elizadle et al. 2004); Chaplygin gas and its generalization (Kamenshchik et al. 2001; Bengochea 2011), holographic DE (Cohen et al. 1999; Li et al. 2011), agegraphic DE (Wei and Cai 2008a, 2008b), Ricci DE (Gao et al. 2009) have been investigated.

In addition, a modification in gravity such as in $f(R)$ (Elizalde et al. 2011a, 2011b; Cognola et al. 2008; Sotiriou and Faraoni 2010; Chiba 2003; Olmo 2005; Amendola et al. 2007a, 2007b; Amarzguioui et al. 2006; Fay et al. 2007; Santos et al. 2008), or other curvature invariants (Nojiri and Odintsov 2005, 2006a, 2007a, 2011; Felice et al. 2010), by coupling a scalar field to curvature (Nojiri and Odintsov 2004, 2006b, 2007a; Farajollahi et al. 2010), a vector field contribution (Zuntz et al. 2010), or in higher dimensional

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