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ORIGINAL ARTICLE

Tachyon reconstruction of ghost dark energy

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Abstract Recently it has been argued that a possible source for the dark energy may arise due to the contribution to the vacuum energy of the QCD ghost in a time-dependent background. In this paper we establish a connection between interacting ghost dark energy and tachyon field. It is demonstrated that the evolution of the ghost dark energy dominated universe can be described completely by a single tachyon scalar field. The potential and the dynamics of the tachyon field are reconstructed according to the evolutionary behavior of ghost energy density.

Keywords Tachyon · Ghost · Dark energy

1 Introduction

Based on the plenty of observational evidences (Riess et al. 1998, 1999; Perlmutter et al. 1999; Kowalski et al. 2008), in the present time, it is accepted that the universe is undergoing a phase of accelerated expansion due to the presence of an unknown agent namely the "dark energy" (DE). Identifying the origin and nature of this unknown agent has been one of the great challenges in modern theoretical cosmology. Many different approaches have been proposed to solve the DE problem. These approaches can be mainly categorized in two distinct groups. First group are the modified gravity models which propose some serious modifications to Einstein's theory of gravity such as $f(R)$ gravity (Capozziello et al. 2003; Carroll et al. 2004; Nojiri and Odintsov 2007; Sadegh Movahed et al. 2007; Baghram et al. 2009), scalar-tensor theories (Amendola 1999; Uzan 1999; Chiba 1999; Bartolo and Pietroni 2000), Quintessence model (Wetterich 2004; Sadegh Movahed and Rahvar 2006; Rahvar and Sadegh Movahed 2007; Cai et al., Cai et al. 2007a, 2007b) and so on. The second category are those support the idea of the existence of a strange type of energy whose gravity is repulsive and consist an un-clustered component through the universe. The first and simplest candidate for DE is the cosmological constant Λ which has constant equation of state (EoS) parameter $w = -1$ (Sahni and Starobinsky 2000). Although this model has a good agreement with observational data but it suffers several difficulties such as *fine tuning* and *coincidence* problem (Riess et al. 1998, 1999). Further observations detect a small variation in the EoS parameter of DE in favor of a dynamic DE. These observations show that the EoS of DE w is likely to cross the cosmological constant boundary -1 (or phantom divide), i.e. w is larger than -1 in the recent past and less than -1 today (Feng et al. 2005; Alam et al. 2004; Huterer and Cooray 2005). The conventional scalar-field model, the quintessence with a canonical kinetic term, can only evolve in the region of $w > -1$, whereas the model of phantom with negative kinetic term can always lead to $w \leq -1$. Neither the quintessence nor the

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