Astrophys Space Sci (2013) 345:399–403
DOI 10.1007/s10509-013-1395-4

ORIGINAL ARTICLE

Correspondence between fermionic field and other dark energies

Sayani Maity · Ujjal Debnath

Received: 20 January 2013 / Accepted: 19 February 2013 / Published online: 27 February 2013

Abstract In this work, we have considered different candidates of dark energy such as tachyonic field, DBI-essence, hessence, k-essence and dilaton dark energy in the framework of f-essence cosmology and investigated the consequences for their co-existence. Also we have reconstructed the potential functions and the scalar fields in this scenario. The potential function can be directly obtained in terms of fermionic kinetic term and fermionic Lagrangian density.

Keywords Dark energy · Fermionic field

1 Introduction

In Cosmology, the investigation for the constituents responsible for the accelerated periods in the evolution of the universe is of great interest. Previously it was believed that the universe is matter dominated. Recent observations of type Ia supernovae (SNIa) indicate that our universe is now undergoing an accelerating expansion (Perlmutter et al. 1999; Riess et al. 1998). This direct evidence of cosmic acceleration seems to change the entire picture of our matter dominated universe. Some other observations, such as cosmic microwave background fluctuations and large scale structure, provide an indirect evidence. The mysterious dark energy with negative pressure has been proposed as a cause for the current accelerated phase of the universe. Present cosmological observational data suggest that universe is dominated by this dark energy with 70 % of the total. So the feature of the universe naturally depends on the nature of the dark energy. The most natural candidate for dark energy is Cosmological Constant with fixed equation of state (EOS) $w = -1$. If it is quintessence then $-1 < w < -1/3$ and if it is phantom then $w < -1$. The constant EOS $w = -1$ is called phantom divide. There are some dark energies which can cross the phantom divide from both sides. There are other dark energy candidates namely tachyonic field (Sen 2002), DBI-essence (Martin and Yamaguchi 2008), hessence (Wei et al. 2005), k-essence (Armendariz-Picon et al. 2001), Quintom (Cai et al. 2010) and dilaton dark energy (Lu et al. 2004) which drive acceleration of the universe.

Recently several approaches were made to explain accelerated expansion by choosing fermionic field (Myrzakulov 2010) as the gravitational sources of energy. Ribas et al. (2005), investigated whether fermionic field, with a self interacting potential that depends on scalar and pseudo scalar invariants, could be responsible for accelerated periods during the evolution of the universe, where a matter field would answer for the post inflation decelerated periods. Fermionic field behaves like an inflation field for the early universe. In the recent years, the k-essence model has received much attention, where it is still worth investigating in a systematic way the possible cosmological behavior of the k-essence. Now recently, a new model named as g-essence was proposed by Yerzhanov et al. (2010) which is a more generalized version of k-essence. In fact, the g-essence contains, as particular cases, two important models: k-essence and f-essence. Note that f-essence is the fermionic counterpart of k-essence. Jamil et al. (2011, 2012)

S. Maity
Department of Mathematics, Techno India Salt Lake, Sector-V, Kolkata 700091, India
e-mail: sayani.maity88@gmail.com

U. Debnath (✉)
Department of Mathematics, Bengal Engineering and Science University, Shibpur, Howrah 711103, India
e-mail: ujjal@iucaa.ernet.in

U. Debnath
e-mail: ujjaldebnath@yahoo.com