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ORIGINAL ARTICLE

Non-minimal braneworld inflation after the *Planck*

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Abstract The recently released Planck data have constrained 4-dimensional inflationary parameters even more accurately than ever. We consider an extension of the braneworld model with induced gravity and a non-minimally coupled scalar field on the brane. We constraint the inflation parameters in this setup, by adopting six types of potential, in confrontation with the joint Planck + WMAP9 + BAO data. We show that a potential of the type $V(\varphi) = V_0 \exp(-\beta\varphi)$ has the best fit with newly released observational data.

Keywords Braneworld inflation · Non-minimal coupling · Observational constraint

1 Introduction

The early time inflationary stage of the universe evolution can address successfully some problems of the standard big bang cosmology such as the flatness, horizon and relics problems. Several theoretical approaches have been proposed to model an inflationary universe. One of the simple inflationary models is the one in which the universe is filled with a canonical scalar field (Inflaton) (Guth 1981; Linde 1982; Albrecht and Steinhard 1982; Linde 1990; Liddle and Lyth 2000; Lidsey et al. 1997; Riotto 2002; Lyth and Liddle 2009). In order to run inflation successfully, the potential energy of the inflaton should dominate the kinetic energy of the field. But, this simple inflation paradigm, suffers by itself from several problems with no concrete solutions (Brandenberger 2005; Lidsey et al. 1997). So, other inflationary models such as the braneworld models (Maartens et al. 2000; Cai and Zhang 2004; del Campo and Herrera 2007; Nozari et al. 2011; Nozari and Rashidi 2012), models with non-minimally coupled inflaton field (Faraoni 1996, 1999, 2000; Fakir et al. 1992; Libanov et al. 1998; Hwang and Noh 1999; Tsujikawa et al. 1999; Nozari and Shafizadeh 2010; Nozari and Rashidi 2013), modified gravity (Nojiri and Odintsov 2008a, 2008b; Cognola et al. 2008), and so on, with a wide range of potentials and with successes and shortcomings, have attracted much attention these years. In this regard, a large number of models have been proposed but this does not mean that all of these models are observationally viable. For a model to be viable, its consistency with observational data is inevitable. Also a successful inflationary model is the one that can provide a mechanism for generating the initial fluctuations and perturbations in the early universe and therefore seed the formation of the structures in the universe. In this regard, fluctuation in the scalar field leads to the scalar power spectra and fluctuation in the transverse and traceless parts of the metric leads to the tensor power spectra (Guth 1981; Linde 1982; Albrecht and Steinhard 1982; Linde 1990; Liddle and Lyth 2000; Lidsey et al. 1997; Riotto 2002; Lyth and Liddle 2009). The scalar power spectrum of the perturbation is nearly scale-invariant, that is, the spectral index is about unity. The exact value of the spectral index can be obtained by using the observational data. The running of the spectral index and also, the ratio between the amplitudes of tensor and scalar perturbations (tensor-to-scalar ratio) are others inflationary

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