Astrophys Space Sci (2012) 339:111–121
DOI 10.1007/s10509-012-0980-2

ORIGINAL ARTICLE

On the dissipative non-minimal braneworld inflation

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Received: 14 December 2011 / Accepted: 5 January 2012 / Published online: 19 January 2012

Abstract We study the effects of the non-minimal coupling on the dissipative dynamics of the warm inflation in a braneworld setup, where the inflaton field is non-minimally coupled to induced gravity on the warped DGP brane. A warped DGP scenario is a hybrid model containing both DGP and RSII character. We study with details the effects of the non-minimal coupling and dissipation on the inflationary dynamics on *the normal DGP branch* of this hybrid scenario in the high-dissipation and high-energy regime. We show that incorporation of the non-minimal coupling in this setup decreases the number of e-folds relative to the minimal case. We also compare our model parameters with recent observational data.

Keywords Warm inflation · Braneworld scenario · Scalar-tensor theories

1 Introduction

Standard big bang cosmology, with its great successes in confrontation with observational data, has several shortcomings, part of which can be explained naturally in inflation paradigm. Inflation is also a successful scenario for production and evolution of the perturbations in primary stages of the universe evolution (Liddle and Lyth 2000). While inflationary scenario is successful in these respects, there is a problem for realization of this scenario that we do not know how to integrate it with ideas of particle physics (Brandenberger 2005; Lidsey et al. 1997). From a thermodynamic viewpoint, there are two dynamical realizations of inflation: In the standard inflation scenario known as *supercooled inflation*, radiation is red-shifted during expansion and a vacuum dominated universe is the result of this exponential expansion. This picture gives an isentropic perspective of the inflation paradigm. In this picture, the universe expands in inflation phase and its temperature decrease rapidly. When inflation ends, a reheating period introduces radiation into the universe. The fluctuations during this inflation phase are zero-point ground state fluctuations and evolution of the inflaton field is governed by the ground state evolution equation. In this model, there are no thermal perturbations and therefore, density perturbations are adiabatic. To have a radiation dominated universe at the end of this inflationary phase, a reheating period is needed to fill the universe with radiation. This model separates expansion and reheating into two distinguished time periods. However, energy transfer from potential energy to radiation is a nontrivial aspect of this supercooled inflation. As a second alternative, *warm inflation* proposed firstly by Berrera, is a successful scenario to overcome this difficulty (Berera 1995, 2000, 2005, 2006; Berera and Kephart 1999; Bellini 1999a, 1999b; Brandenberger and Ymaguchi 2003; Hall et al. 2004a, 2004b; Gupta 2006; Bastero-Gil and Berera 2007; Berera et al. 1999, 2009; Moss and Xiong 2008; Zhang 2009; Romero and Bellini 2009; del Campo et al. 2010; Matsuda 2010; Bueno Sanches et al. 2011; Cai et al. 2011; Bastero-Gil et al. 2011). In this scenario, due to inflaton interactions with other fields, dissipative effects arise so that radiation production occurs concurrently with exponential expansion. Several mechanisms for implementing such a dissipation during inflation have been proposed (Berera and Kephart 1999; Berera and

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