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ORIGINAL ARTICLE

Logarithmic Entropy-Corrected Holographic Dark Energy in Hořava-Lifshitz cosmology with Granda-Oliveros cut-off

Antonio Pasqua · Surajit Chattopadhyay

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Abstract In this work, we studied the Logarithmic Entropy-Corrected Holographic Dark Energy (LECHDE) model in a spatially non-flat universe and in the framework of Hořava-Lifshitz cosmology. As infrared cutoff of the system we considered the cut-off recently proposed by Granda and Oliveros which contains two terms, one proportional to H^2 and one to $\dot{H}$. For the two cases containing non-interacting and interacting Dark Energy (DE) and Dark Matter (DM), we obtained the exact differential equation that determines the evolution of the density parameter. Moreover, we derived the expressions of the deceleration parameter q and, using a parametrization of the equation of state (EoS) parameter ω_D of our model as $\omega_D(z) = \omega_0 + \omega_1 z$, we derived both the expressions of ω_0 and ω_1 for both non-interacting and interacting cases. All derivations made in this work are done in small redshift approximation and for low redshift expansion of the equation of state (EoS) parameter.

Keywords Dark Energy · Hořava-Lifshitz · Granda-Oliveros cut-off

1 Introduction

Recent astrophysical and cosmological observations clearly indicate that the universe is experiencing a phase of accelerated expansion (de Bernardis et al. 2000; Perlmutter et al. 1999; Riess et al. 1998; Seljak et al. 2005; Astier et al. 2006; Abazajian et al. 2004, 2005; Tegmark et al. 2004; Spergel et al. 2003; Allen et al. 2004; Bennett et al. 2003). The evidence of this cosmic acceleration implies that, if Einstein's theory of General Relativity is assumed valid on cosmological scales, the universe must be dominated by a mysterious and unknown kind of undetectable energy which has some peculiar characteristics. For example it must not be clustered on large length scales and its pressure p must be negative. In order to find a reasonable model which is able to explain the present universe, scientists began to investigate the possible acceptable explanations of this accelerated expansion of the universe. In relativistic cosmology, the cosmic acceleration can be described with the help of a perfect fluid which pressure p and energy density ρ satisfy the condition $\rho + 3p < 0$. This kind of fluid with negative pressure is named Dark Energy (DE). The condition $\rho + 3p < 0$ implies that the EoS parameter ω $(= p/\rho)$ of DE must obey the constrain $\omega < -1/3$, while from an observational point of view it is a daunting task to constrain its exact value. Since the fundamental theory of physics which can explain the microscopic physics of DE is unknown until now, phenomenologists continue to reconstruct and suggest different models based on its macroscopic behavior.

The largest part of the total energy density ρ_{tot} of the present universe is contained in the two dark sectors which contribute to the composition of the universe, i.e. the Dark Energy (DE) and the Dark Matter (DM), which represent, respectively, the 73 % and the 23 % of ρ_{tot}. The Baryonic Matter (BM) we are able to observe with our scientific instruments contributes for about the 4 % of ρ_{tot}, while the contribution given by the radiation term to the cosmic energy density is practically negligible.

The cosmological constant Λ (with EoS parameter equal to -1) is the first theoretical model created to describe the

A. Pasqua (✉)
Department of Physics, University of Trieste, Via Valerio, 2, 34127 Trieste, Italy
e-mail: toto.pasqua@gmail.com

S. Chattopadhyay
Pailan College of Management and Technology, Bengal Pailan Park, Kolkata 700 104, India
e-mail: surajcha@iucaa.ernet.in