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Tsallis Holographic Dark Energy as Dynamical Vacuum: A Dynamical System Approach

Tsallis and Cirto introduced a generalized entropy for the black hole, known as Tsallis entropy, given by $S = \gamma A^{\delta}$, where γ is an unknown constant, A is the horizon area, and δ is the Tsallis parameter, to maintain the extensivity of the thermodynamical entropy. Accordingly, we defined a dynamical dark energy, known as the Tsallis holographic dark energy (THDE), using the holographic principle by choosing Granda-Oliveros (GO) scale as the IR cutoff. We consider THDE as the dynamical vacuum. We then investigate the evolution of the universe composed of THDE and a pressure-less dark matter that interact through mutual interaction. This model predicts the evolution of the universe from a matter-dominated decelerated epoch to a late accelerated epoch. Without interaction, the model predicts a ΛCDM-like behavior with an effective cosmological constant. We constrain the model with the latest observational data. We also performed a dynamical analysis of the model with the autonomous system of equations and analyzed the phase spaces. The critical points obtained from the phase space analysis of the model portrays a consistent background evolution of the universe from the unstable prior decelerated phase to the stable late accelerated phase.

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