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Dark Energy Explained by a Novel Quintessential Inflation Model

ISLAM KHAN, GUY WORTHEY, Washington State University — Investigating the nature of dark energy in our universe is one of the main challenges of modern cosmology. This exotic source of stress-energy responsible for the late-time cosmic acceleration lacks a fundamental and well-defined theory. The simplest extension to the ΛCDM model is offered by dynamical dark energy models in which the late-time accelerated expansion is driven by an evolving scalar field, dubbed quintessence, undergoing motion on a fixed potential. Given their similarity in nature, there is a possibility that the energy density of the inflaton field that drove inflation has survived until late times to behave as quintessence. In this work, we describe a novel approach of unifying the two phases of accelerated expansions of the universe using a model that combines hilltop inflation with oscillating quintessence, while treating the reheating mechanism conventionally. The effects of the various models are analyzed using lattice simulations and tested against the 2018 Planck mission data. We show that a quintessential inflation model with a Coleman-Weinberg potential is consistent with the observed constraints and it allows for various cosmological predictions including the reheating temperature, and the mass and couplings of the inflaton field to be made.

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