An investigation of the logotropic equation of state for the Chaplygin gas, a generalized holographic model, and thermodynamic analysis using scalar fields

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Abstract:

This study proposes a method to reconstruct a generalized form of holographic dark energy and to analyse its cosmology, based on a logotropic equation of state [1]. By assuming that the dark energy density is caused by holographic Ricci dark energy [2], one can calculate a scale factor for the universe's overall energy density, provided by baryons, dark matter, and dark energy density. For the situation where the internal energy is in logarithmic form [3], the equation of state parameter is similarly obtained. In the following stage, a generalized Chaplygin gas [4] is investigated using a logotropic equation of state, considering the scenario of a logarithmic internal energy. Modified generalized Chaplygin gas [5] is also examined in the situation of logarithmic internal energy with logotropic equation of state, and related reconstruction is carried out. The generalized second law of thermodynamics [6] is subsequently validated for event, particle, and Hubble horizons after taking into account the phantom and quintessence models using a logotropic technique.

Keywords: Logotropic equation of state; logarithmic internal energy; generalized second law of thermodynamics; holographic Ricci dark energy; Chaplygin gas.

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