



Contribution ID: 15

Type: Poster

Information theory and fuzzy set theory based validation of modified Chaplygin gas model with a bouncing scale factor under the purview of bulk viscosity

Friday 16 December 2022 14:00 (1 hour)

The current work focuses on the bounce realization and inflationary dynamics of modified Chaplygin gas under the purview of bulk viscosity. The bouncing scale factor considered here corresponds to $a(t) = \frac{a(1+3t^2\sigma)^{\frac{1}{3}}}{2}$ and the modified Chaplygin gas is characterized by the barotropic equation of state (EoS) $p = \epsilon\rho - (1 + \epsilon)A\rho^{-\gamma}$. The EoS parameter, reconstructed for the bouncing scale factor, has been studied, and we have demonstrated the pre-bounce and post-bounce realizations. Also, we have carried out the Hubble flow dynamics under the current scenario regarding the e-folding number. In the next phase of the study, we conducted a statistical analysis of the model parameters and subsequently implemented the Shannon entropy maximization procedure to optimize the model parameters. For the Shannon entropy maximization, we have explored the redshift data. Finally, we have assessed the model using fuzzy set theory. We have developed a continuous fuzzy membership function and assessed the model by judging the fuzzy membership grades of the model-generated EoS parameters for different redshifts to assess its departure from Λ CDM.

Session

Astroparticle Physics and Cosmology

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Session Classification: Poster - 4