A unified TDiff invariant field theory for the dark sector

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Abstract

In this work we present a unified model for the cosmological dark sector. The theory is based on a simple minimally coupled scalar field whose action only contains a canonical kinetic term and is invariant under transverse diffeomorphisms (TDiff). The model has the same number of free parameters as ΛCDM. We confront the predictions of the model at the background level with data from Planck 2018 CMB distance priors, Pantheon+ and SH0ES SNIa distance moduli, BAO data points from 6dFGS, BOSS, eBOSS and DES and measurements of the Hubble parameter from cosmic chronometers. The model provides excellent results in the joint fit analysis, showing very strong evidence compared to ΛCDM in the deviance information criterion (DIC). We also show that the Hubble tension between Planck 2018 and SH0ES measurements can be alleviated in the unified TDiff model although further analysis is still needed.