

New Isocurvature Constraints and its Axionic Interpretations

Although measurements of the Cosmic Microwave Background (CMB) have shown a nearly scale-invariant primordial spectrum of adiabatic perturbations, in which the energy densities of different components (radiation, baryons, and dark matter) fluctuate proportionally, there could also exist isocurvature perturbations, in which density fluctuations of the individual components differ from the adiabatic mode. Cold dark matter isocurvature (CDI) perturbations with a variety of spectral tilts generated in pre-inflationary axion models provide one such example. In this article, we present the most updated constraints on these axion CDI perturbations using the latest CMB anisotropy measurements from Planck, the Atacama Cosmology Telescope (ACT), and the South Pole Telescope (SPT).

We study both fixed spectral indices with values ranging from red- to blue-tilted spectra as well as the case with a free index. We find that the constraint on the spectral index gets moderately improved with the combined datasets compared to Planck alone, while the bounds on the isocurvature amplitudes for fixed spectral indices we consider do not get tighter.

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