

U02a Constraints on Cosmological Parameters from CMB Power Spectra and Cosmic Reionization History

影浦優太 (東京大学)、大内正己 (国立天文台/東京大学)、直川史寛、松本明訓、梅田滉也、播金優一、中根美七海 (東京大学)、Tran Thi Thai(国立天文台)

Cosmic microwave background (CMB) power spectra are described by five cosmological parameters and the optical depth τ in the flat Λ CDM model. Although τ is inferred from CMB large-scale E-mode polarization, the measurements are still challenging due to statistical and potential systematic errors. Some recent studies based on the Baryon Acoustic Oscillation (BAO) measurements suggest τ values different from the previous CMB results. In this work, we present a determination of τ that is independent of large-scale E-mode polarization based on cosmic reionization history. Recent galaxy and quasar observations tightly constrain reionization history. We reconstruct the history based on these results using Gaussian process regression. Combining this reionization history with CMB power spectra excluding large-scale E-modes, we obtain $\tau = 0.0533 \pm 0.0021$. This result is consistent with E-mode based constraints and provides a stronger constraint on τ . By breaking the degeneracy between τ and other cosmological parameters, our results exhibit a 2.6σ tension with DESI DR2 BAO, potentially indicating cosmology beyond Λ CDM such as dynamical dark energy. Finally we derive an upper limit on the sum of neutrino masses, $\Sigma m_\nu < 0.0614$ eV, which strongly favors the normal mass ordering. Combined with neutrino oscillation data, this implies a precise constraint of $\Sigma m_\nu = 0.060 \pm 0.001$ eV.