

Probing dark energy evolution with Quia quasars through the integrated Sachs-Wolfe effect

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The Integrated Sachs–Wolfe (ISW) effect probes the late-time evolution of gravitational potentials and provides a complementary test of the nature of dark energy. We investigate whether the redshift evolution of the ISW effect can provide new constraints on the time evolution of dark energy. We consider theoretical predictions for the standard Λ CDM cosmology and alternative w_0 w Λ CDM models favoured by recent DESI BAO and DES Y6 constraints. We perform a tomographic cross-correlation analysis of the Quia quasar catalogue and Planck CMB temperature maps to measure the ISW signal over a broad redshift range, spanning about $(10h^{-1}\text{Gpc})^3$ comoving volume. We assess the robustness of the inferred ISW amplitude against variations in sky coverage, multipole range, and tomographic binning. We detect the ISW effect at a significance of 2.8σ , corresponding to an amplitude of $A_{\text{ISW}} = 1.69 \pm 0.61$ relative to the Planck Λ CDM prediction. The inferred signal remains stable against various analysis choices, including various CMB maps (SMICA, NILC, SEVEM), different choices of ℓ_{max} and the number of multipole bins, and an alternative quasar bias model. The measured ISW amplitude is moderately stronger than predicted by the fiducial Λ CDM cosmology, and the alternative w_0 w Λ CDM models do not account for this discrepancy. Future tomographic ISW measurements with improved quasar catalogues from Gaia and forthcoming wide-area galaxy surveys such as Euclid and DESI will help clarify the origin of this difference.

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