

The Atacama cosmology telescope: CMB polarization at $200 < l < 9000$

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Abstract

We report on measurements of the cosmic microwave background (CMB) and celestial polarization at 146 GHz made with the Atacama Cosmology Telescope Polarimeter (ACTPol) in its first three months of observing. Four regions of sky covering a total of 270 square degrees were mapped with an angular resolution of $1.3'$. The map noise levels in the four regions are between 11 and $17 \mu\text{K-arcmin}$. We present TT, TE, EE, TB, EB, and BB power spectra from three of these regions. The observed E-mode polarization power spectrum, displaying six acoustic peaks in the range $200 < l < 3000$, is an excellent fit to the prediction of the best-fit cosmological models from WMAP9+ACT and Planck data. The polarization power spectrum, which mainly reflects primordial plasma velocity perturbations, provides an independent determination of cosmological parameters consistent with those based on the temperature power spectrum, which results mostly from primordial density perturbations. We find that without masking any point sources in the EE data at $l < 9000$, the Poisson tail of the EE power spectrum due to polarized point sources has an amplitude less than $2.4 \mu^2$ at $l = 3000$ at 95% confidence. Finally, we report that the Crab Nebula, an important polarization calibration source at microwave frequencies, has 8.7% polarization with an angle of $150.7^\circ \pm 0.6^\circ$ when smoothed with a $5'$ Gaussian beam..