

MAR14-2013-020620

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Probing the Last 13.8 Billion Years in the Universe with the Atacama Cosmology Telescope

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The Atacama Cosmology Telescope (ACT) is a 6 m special purpose telescope designed to measure the cosmic microwave background (CMB) at millimeter wavelengths. ACT has an angular resolution of better than $1.4'$, which means it measures not only the primordial fluctuations in the CMB, but is also sensitive to the intervening universe in several ways. ACT observes from a site at 5300 m in the Atacama Desert in Chile. This midlatitude site allows ACT to map regions of the sky in which there exist substantial data from surveys at other wavelengths. ACT detects clusters of galaxies through their Sunyaev-Zeldovich effect (a spectral effect due to scattering off the hot electrons in the clusters). ACT measures clusters directly, in blind surveys, and also makes statistical measurements based on stacking analyses and by measuring the 3-point function in the maps. Furthermore, gravitational lensing by all the intervening matter from the primordial epoch to now leads to signatures in the 4-point functions in the ACT maps. Cross-correlating the ACT lensing deflection field with other optical surveys in the same region is a particularly fruitful way of deriving cosmological information on the expansion history of the universe.