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Cluster Cosmology with the South Pole Telescope

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The South Pole Telescope (SPT) is a 10-meter millimeter-wavelength telescope optimized for high resolution observations of the Cosmic Microwave Background (CMB). The SPT has been used to conduct several wide-area surveys: the 2500-square-degree SPT-SZ survey (completed in 2011) as well as two recently completed surveys conducted using the SPTpol receiver: the 500-square-degree SPTpol Survey and the SPTpol Extended Cluster Survey (the former surveyed ~20% of the SPT-SZ footprint to a level 3x deeper than the SPT-SZ survey, the latter covered an additional 2500-square-degrees to somewhat shallower depths than SPT-SZ).

One of the primary objectives of the wide-area SPT surveys was the construction of a mass-limited sample of galaxy clusters identified via the thermal Sunyaev- Zel'dovich (SZ) effect, through which massive clusters imprint subtle temperature distortions on the CMB sky. The abundance of such clusters is a powerful cosmological probe as it depends sensitively upon both the expansion history of the universe and the growth of density fluctuations. In this talk I will discuss progress analyzing these three datasets including updated cosmological constraints from the initial SPT-SZ cluster sample using new weak lensing data as well as ongoing work characterizing the strong lensing properties of these systems using the new PISCO imager on Magellan. The results presented in this talk will be significantly improved with data from the SPT-3G survey—deployed in Jan 2017—that will identify an order of magnitude more clusters than past generation SZ surveys.

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