

# Galaxy Clusters Selected with the Sunyaev-Zel'dovich Effect from 2008 South Pole Telescope Observations

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We present a detection-significance-limited catalog of 21 Sunyaev-Zel'dovich selected galaxy clusters. These clusters, along with 1 unconfirmed candidate, were identified in 178 deg<sup>2</sup> of sky surveyed in 2008 by the South Pole Telescope to a depth of 18 uK-arcmin at 150 GHz. Optical imaging from the Blanco Cosmology Survey (BCS) and Magellan telescopes provided photometric (and in some cases spectroscopic) redshift estimates, with catalog redshifts ranging from  $z=0.15$  to  $z>1$ , with a median  $z = 0.74$ . Of the 21 confirmed galaxy clusters, three were previously identified as Abell clusters, three were presented as SPT discoveries in Staniszewski et al, 2009, and three were first identified in a recent analysis of BCS data by Menanteau et al, 2010; the remaining 12 clusters are presented for the first time in this work. Simulated observations of the SPT fields predict the sample to be nearly 100% complete above a mass threshold of  $M_{200} \sim 5 \times 10^{14} M_{\text{sun}}/h$  at  $z = 0.6$ . This completeness threshold pushes to lower mass with increasing redshift, dropping to  $\sim 4 \times 10^{14} M_{\text{sun}}/h$  at  $z=1$ . The size and redshift distribution of this catalog are in good agreement with expectations based on our current understanding of galaxy clusters and cosmology. In combination with other cosmological probes, we use the cluster catalog to improve estimates of cosmological parameters. Assuming a standard spatially flat  $\Lambda$ CDM cosmological model, the addition of our catalog to the WMAP 7-year analysis yields  $\sigma_8 = 0.80 \pm 0.09$  and  $w = -1.05 \pm 0.29$ , a  $\sim 50\%$  improvement in precision on both parameters over WMAP7 alone.

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