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Microwave kinetic inductance detector development for the SPT-3G+ camera on the South Pole Telescope

Thursday, 9 November 2023 12:00 (15 minutes)

SPT-3G+ is the planned next-generation camera for the South Pole Telescope (SPT). Building on three generations of increasingly sensitive SPT cameras, SPT-3G+ will observe the mm/sub-mm sky at 220, 285, and 345 GHz, beyond the peak of the cosmic microwave background (CMB) blackbody spectrum. Consisting of 34,000 monochroic microwave kinetic inductance detectors (MKIDs) across seven wafers, SPT-3G+ will provide a high-frequency, high sensitivity complement to the existing SPT-3G dataset.SPT-3G+ will target cosmological observables such as the kinematic Sunyaev-Zel'dovich (kSZ) effect, placing new constraints on the timing and duration of reionization, and the recombination-era Rayleigh scattering of the CMB, a new probe of cosmic expansion and ionization history. It will also enable the detection of new high-redshift dusty star-forming galaxies, extend the SPT cluster search to higher redshift, characterize astrophysical foregrounds, such as the cosmic infrared background, on small angular scales, and extend SPT astrophysical transient observations into the sub-mm band. I will present a brief overview of the SPT-3G+ instrument, followed by a more detailed discussion of the SPT-3G+ detectors. I will show updated SPT-3G+ pixel designs at all three observation frequencies along with an overview of array fabrication efforts at both the University of Chicago and Argonne National Laboratory. Finally, I will show test results from recent prototype wafers and describe upcoming plans for fabrication and testing as we move further along the path toward full deployment-sized arrays.

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