Contributed Talk

Multi-chroic Dual-polarization Bolometric Detectors for Studies of the Cosmic Microwave Background

Aritoki Suzuki (University of California, Berkeley)

Co-Authors: A. Suzuki, K. Arnold, J. Edwards, G. Engargiola, A. Ghribi, W. Holzapfel, A. T. Lee, X. Meng, M. J. Myers, R. O'Brient, E. Quealy, G. Rebeiz, P. Richards, D. Rosen, P. Siritanasak

We are developing multi-chroic antenna-coupled Transition Edge Sensor (TES) bolometer detectors for Cosmic Microwave Background (CMB) polarimetry. Multi-chroic detectors increase focal plane area-efficiency, thus the mapping speed per focal plane area and provide greater discrimination of polarized galactic foregrounds with no increase in weight or cryogenic cost. In each pixel, a silicon lens-coupled dual-polarized sinuous antenna collects photons over a two-octave frequency band. The antenna couples the broadband millimeter wave signal into microstrip transmission lines, and on-chip filter banks split the broadband signal into several frequency bands. Separate TES bolometers detect the power in each frequency band and linear polarization state. We will describe the design and performance of these devices and present optical data taken with prototype pixels. Our measurements of dual-polarization pixels in two, three, and seven frequency bands show beams with percent-level ellipticity, and percent-level cross-polarization leakage. We will also describe the development of large arrays of theses multi-chroic pixels. Finally, we will describe kilo-pixel array of these detectors planned for the LiteBIRD CMB satellite and an upgrade for the ground-based Polarbear CMB experiment that will achieve unprecedented mapping speed.