16th International Workshop on Low Temperature Detectors
20 24 July 2015

Development of the Next Generation of Multi-chroic Antenna Coupled Transition Edge Sensor Detectors for CMB Polarimetry

Main author:

WESTBROOK Benjamin

Co-authors:

Arnold Kam, UC San Diego
Cukierman Ariel, UC Berkeley
Holzapfel William, UC Berkeley
Lee Adrian, UC Berkeley
Raum Christopher, UC Berkeley
Suzuki Aritoki, UC Berkeley
Westbrook Benjamin, UC Berkeley

We present the development of the next generation of multi-chroic antenna coupled TES detectors optimized for precision measurements of polarization of the Cosmic Microwave Background (CMB) and galactic foreground. These pixels employ a polarization sensitive broadband self-complementary sinuous antenna to feed on-chip band defining filters before delivering the power to load resistors coupled to a transition edge sensor (TES) on a released bolometer island. This is a candidate detector for the LiteBIRD and EBEX10K missions in their search for extremely faint polarization signals embedded in the CMB, most notably the large angular scale ``B-mode'' polarization produced by gravitational waves during the inflationary epoch. Recent results from the BICEP2-PLANCK collaboration have demonstrated the need to map the polarization of the sky over a broad range of frequencies both above and below the peak of the CMB at 150 GHz in order to accurately account for foreground contamination. As detector counts continue to rise, so does the need for efficient use of focal plane space for both optical and cryogenic reasons. One technological solution is the implementation of mulitchroic-antenna coupled TES bolometers currently being developed by POLARBEAR-2 and SPT-3G. Expanding the both bandwidth and the band count per pixel of this technology provides an elegant approach to this challenge as they can be tuned to monitor polarization between 40 and 350 GHz with excellent optical and noise performance which maximizes the the sensitivity per focal plane area. This presentation will include results from the design, construction, and characterization of 3 new pixel types: a triplexing pixel with bands at 40, 60, and 90 GHz, a triplexing pixel with bands at 220, 280, and 350 GHz, and tetraplexing pixel with bands at 90, 150, 220, and 280 GHz.