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

Characterizing Detectors with a Half-Wave Plate on the Atacama B-mode Search Instrument

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The Atacama B-Mode Search (ABS) instrument is a cryogenic crossed-Dragone telescope located at an elevation of 5200 m in the Atacama Desert in Chile that observed for three seasons between February 2012 and October 2014. ABS observed the Cosmic Microwave Background (CMB) at large angular scales (40<l<500) with the aim of measuring or limiting the B-mode polarization spectrum around the primordial B-mode peak from inflationary gravity waves at l~100. The ABS focal plane consists of 240 pixels designed for observation at 145 GHz that are read out using time-domain multiplexing. Each pixel has an individually machined corrugated feedhorn and contains two transition-edge sensor (TES) bolometers coupled to orthogonal polarizations from a planar ortho-mode transducer (OMT). ABS employs an ambient temperature, rapidly rotating half-wave plate (HWP), which eliminates the need for pair differencing detectors to gain polarization sensitivity, mitigates systematic effects, and reduces atmospheric noise, allowing for the recovery of large angular scales. While the polarization signal is detected in the bolometers at the fourth harmonic of the HWP rotation frequency, the second harmonic contains further information about the instrument and detectors. I will discuss how the second harmonic of the HWP rotation frequency can be used for data selection and determining changes in the detector responsivities.