TES ANTENNA COUPLED POLARIMETER

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We describe the design of an antenna coupled bolometer array operating at 150 GHz optimized for the measurements of the Cosmic Microwave Background polarization. The array consists of 8×8 pixels, with 4 TES bolometers per pixel. At each pixel, the Mm-wave radiation is detected by the 16×16 planar dipole array, added up coherently with a series of binary summing trees to form a 2fλ beam, and sent to 4 TES bolometers through superconducting microstrips. The other key components between the antenna and the TES are a band-defining lumped-element filter, a microstrip 180° hybrid, and a polarization switch that uses SIS junctions. The difference between the first bolometer pair gives the Stokes Q parameter, and the difference between the second pair gives the Stokes U parameter. The modulation can be done at a frequency up to a few Hz with the SIS switch to avoid 1/f noise. The entire focal plane array can be fabricated on a 4 inch silicon wafer using photolithographic techniques. It can be scaled up easily by joining sub-arrays. We have fabricated several test devices to assess the performance of various components in the system. The Molybdenum-Gold bi-layers bolometers are shown to have stable Tc and appropriate resistance for SQUID multiplexers (MUX). We demonstrated the read-out of an 8 element Mo/Au bolometer array with the MUX system developed by the NIST group, and showed that the read-out noise is not significant. The angular response of the phase array is measured with SIS junctions and found to be consistent with the theoretical calculations. We also present the latest progress in the testing of the filter, the switch, and the 180° hybrid.

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