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Fabrication of OMT-coupled MKIDs for CMB Observations

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Future cosmic microwave background (CMB) experiments, including the large scale ground based Stage Four CMB Experiment (CMB-S4), satellites, and balloons, aim to map the CMB to an unprecedented precision in order to answer several key questions in cosmology. However, to reach the target noise sensitivity, more than 100,000 detectors will be needed. Microwave Kinetic Inductance Detectors (MKIDs) are ideal detectors for experiments using large number of detectors due to their intrinsic multiplexing capabilities and ease of fabrication. We present fabrication procedure for making a prototype orthomode transducer (OMT)-coupled MKID array optimized for CMB observations. These devices are made from silicon-on-insulator (SOI) wafers. A set of planar OMTs couples the two polarizations of light from our feedhorn to separate Nb/SiN/Nb microstrips, which are then coupled to Al lumped-element KIDs (LEKIDs). The silicon and oxide layer on the backside of the OMT and MKIDs are etched away using deep reactive ion etch (DRIE) for better optical coupling and two-level system (TLS) noise mitigation. We also show the preliminary results from optical and dark testing measurements.

Less than 5 years of experience since completion of Ph.D

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Student (Ph.D., M.Sc. or B.Sc.)

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