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Transformer-Coupled TES Frequency Domain Readout Prototype

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Frequency domain multiplexing (fMUX) is a mature readout scheme for TES detectors in the millimetre and sub-millimetre bands. It is implemented at MHz carrier frequencies for the South Pole Telescope, POLAR-BEAR, and Simons Array, and is planned for deployment on the LiteBIRD space polarimeter. Existing implementations couple to the detectors with low-noise, low-input impedance SQUID transimpedance amplifiers, and complex arrangements are in place to handle the inherent SQUID non-linearity and tuning requirements. We introduce a new cryogenic amplification scheme that couples the multiplexed TES devices to a traditional FET amplifier using a high turns-ratio, wide-band, cryogenic transformer that steps up the TES impedance to the noise match of the amplifier. We characterize the bandwidth, transimpedance, input impedance, and noise of the transformer-coupled fMUX system to demonstrate that it is a promising candidate for SQUIDless MHz frequency domain multiplexing.

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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