



Contribution ID: 83

Type: Poster

Recent Advances in Frequency-Multiplexed TES Readout: Vastly Reduced Parasitics and an Increase in Multiplexing Factor with sub-Kelvin SQUIDs

Tuesday, 23 July 2019 18:45 (15 minutes)

Cosmic microwave background (CMB) measurements are fundamentally limited by photon statistics. Therefore, ground-based CMB observatories have been increasing the number of detectors that are simultaneously looking at the sky. Thanks to the advent of monolithically fabricated transition edge sensor (TES) arrays, the number of on-sky detectors has been increasing exponentially for over a decade. The next-generation experiment CMB-S4 will increase this detector count by more than an order of magnitude from the current state-of-the-art to ~500,000.

The readout of such a huge number of exquisitely precise sub-Kelvin sensors is feasible using an existing technology: frequency-domain multiplexing (fMux). To further optimize this system and reduce complexity and cost, we have recently made significant advances including the elimination of 4 K electronics, a massive decrease in parasitic in-series impedances, and a significant increase in multiplexing factor. We will discuss the remaining challenges and prospects for the future.

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

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Session Classification: Poster session

Track Classification: Detector readout, signal processing, and related technologies