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Cosmic ray response of multiplexed TES arrays - results from the stratosphere and the lab.

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Future mm-wave and sub-mm space missions (e.g., PICO, LiteBIRD, SPICA, OST) will employ large arrays of multiplexed Transition Edge Sensor (TES) bolometers that may be vulnerable to frequent 'glitches' caused by cosmic ray (CR) interactions. Such glitches posed a challenge to data analysis from the Planck bolometers, due to the high rate and long duration of glitches from interactions in the surrounding silicon wafer. Because modern TES arrays have densely populated detectors on large, shared substrates and require multiplexing, more empirical study on the CR interactions, multiplexer 'cross-talk', and the challenges in modeling these glitches is needed to inform the design of instruments robust against the high flux of particles beyond our atmosphere. SPIDER is a balloon-borne mm-wave polarimeter employing over a hundred bolometers per 100 cm^2 wafer, totaling 2400 time-domain SQUID-multiplexed (TDM) detectors in its inaugural 2015 Antarctic flight. We have explored the impact of high energy CRs in the aforementioned flight's data and complemented this study with a course of lab tests on a fully multiplexed SPIDER wafer using radioactive sources. Both data sets are informed by Monte Carlo modeling with GEANT4. Flight data is used to study the performance of a full science instrument in a space-like environment, while laboratory tests allow measurements with localized source illumination and at higher sampling rates. We will discuss results from these studies and implications for future work.

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

Y

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

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Primary authors: OSHERSON, Benjamin (University of Illinois - Urbana Champaign); Prof. FILIPPINI, Jeffrey (University of Illinois, Urbana-Champaign); Dr GUALTIERI, Riccardo (University of Illinois at Urbana Champaign)

Co-authors: FU, Jianyang (University of Illinois - Urbana Champaign); GRAMILLANO, Robert; THE SPIDER COLLABORATION

Presenter: OSHERSON, Benjamin (University of Illinois - Urbana Champaign)

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