Contribution ID: **195** Type: **Poster**

Developing a Large -Scale Cryogenic System for the Simultaneous Operation of Three Detector Focal Planes in TolTEC, A New Multichroic Imaging Polarimeter

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

TolTEC is an upcoming multiwavelength imaging polarimeter designed to fill the focal plane of the 50-m diameter Large Millimeter Telescope (LMT). Combined with the LMT, TolTEC will offer high angular resolution (5”-10”) simultaneous, polarization-sensitive observations in three wavelengths: 1.1, 1.4, and 2.0 mm. Additionally, TolTEC will feature mapping speeds greater than 2 $deg^2/mJy^2/hr$, thus enabling wider surveys of large-scale structure, galaxy evolution, and star formation. These improvements are only possible through the integration of approximately 7000 low-noise, high-responsivity superconducting Lumped Element Kinetic Inductance Detectors (LEKIDs). To utilize three focal planes of detector arrays requires the design, fabrication, and characterization of a unique, large-scale cryogenic system. Based on thermal models and expected photon loading, the focal planes must have a base operational temperature below 150 mK. To achieve this base temperature, TolTEC utilizes two cryocoolers, a Cryomech pulse tube cooler and an Oxford dilution refrigerator, to establish four thermal stages: 45 K, 4 K, 1 K, and 100 mK. During the design phase, we developed an object-oriented Python code to model the heat loading on each stage as well as the thermal gradients throughout the system. This model has allowed us to improve thermal gradients in the system as well as locate areas of poor thermal conductivity prior to ending a cooldown. The results of our model versus measurements from our cooldowns will be presented along with a detailed overview of TolTEC’s cryogenic system. We anticipate TolTEC to be commissioned at the LMT in Fall 2019.

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

Y

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

Y

Primary author: DENIGRIS, Nat (University of Massachusetts Amherst)

Co-authors: Dr WILSON, Grant (University of Massachusetts Amherst); Ms EIBEN, Miranda (University of Massachusetts Amherst); MAUSKOPF, Phillip (Arizona State University); Ms LUNDE, Emily (ASU)

Presenter: DENIGRIS, Nat (University of Massachusetts Amherst)

Session Classification: Poster session

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