LABORATORY FOR ELEMENTARY-PARTICLE PHYSICS (LEPP)

LEPP Joint Seminar

Nathan Lourie

University of Pennsylvania

Sub-arcminute Galactic Polarimetry with the Next Generation Balloon-borne Large-Aperture Submillimeter Telescope (BLAST-TNG)

Mapping the polarized thermal dust emission from our galaxy is important for many fields of astrophysics, and recent observations reveal a complex network of filamentary structures which pervade the interstellar medium and molecular clouds, and are rich with prestellar cores. In the infrared and submillimeter, polarized dust emission traces magnetic field patterns which reveal key insights in to the physical processes which regulate the formation of filaments and stars, while for measurements of the cosmic microwave background (CMB) this dust emission is the dominant foreground.

The Next Generation Balloon-borne Large Aperture Submillimeter Telescope (BLAST-TNG) is a submillimeter mapping experiment planned for a long-duration balloon (LDB) flight from McMurdo Station, Antarctica during the 2018-2019 season. BLAST-TNG is the successor to the BLAST-Pol telescope which flew from Antarctica in 2010 and 2012, and produced degree-scale maps of molecular clouds at arcminute resolution. BLAST-TNG will detect submillimeter polarized interstellar dust emission, tracing magnetic fields in galactic molecular clouds. BLAST-TNG will be the first polarimeter with the sensitivity and resolution to probe the ~0.1 parsec-scale features that are critical to understanding the origin of structures in the interstellar medium. BLAST-TNG will also be able to make the deepest maps to date of the dust emission in the types of dark, diffuse regions of the sky favored by state of the art CMB polarization experiments. BLAST-TNG will probe angular scales not well-characterized to date, and explore correlations between diffuse dust emission and structures in the cold neutral medium at submillimeter wavelengths where the intensity of the thermal dust signal dominates.

BLAST-TNG features three microwave kinetic inductance detector (MKID) arrays operating over 30% bandwidths centered at 250, 350, and 500 microns (1200, 857, and 600 GHz). These highly-multiplexed, high-sensitivity arrays, featuring 918, 469, and 272 dual-polarization pixels, are coupled to a 2.5 m diameter primary mirror and a cryogenic optical system providing diffraction-limited resolution of 30", 41", and 50" respectively. The arrays are cooled to ~275 mK in a liquid-helium-cooled cryogenic receiver which will enable observations over the course of a 28-day stratospheric balloon flight. In this talk I will present the design, development, and pre-flight testing of the BLAST-TNG receiver and telescope platform, as well as observation planning ahead of the planned launch in December, 2018.

Friday, September 14, 2018

12:30pm

401 Physical Sciences Bldg.