Planar Antenna-Coupled Superconducting Detectors for CMB Polarimetry

PI: James Bock/JPL

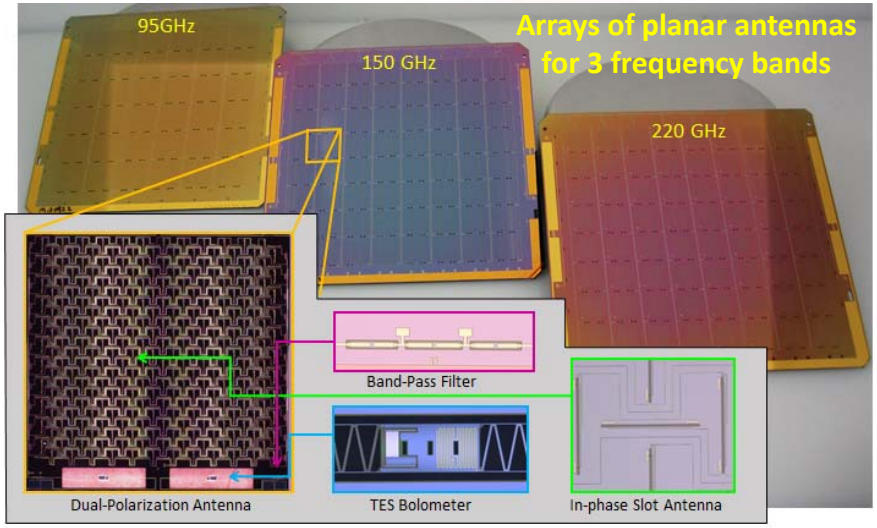
Objectives and Key Challenges:

Advance antenna-coupled superconducting detector technologies for space requirements:

- RF propagation properties
- Beam control and polarized matching
- Extended-frequency antennas
- Detectors stability and cosmic-ray response
- Readout-noise stability
- Modular focal-plane units

Significance of Work:

- Antenna designs for all bands required by the Inflation Probe
- Detector sensitivity, stability, and minimized particle susceptibility appropriate for space-borne observations



Approach:

- Planar antennas provide entirely lithographed fabrication with no coupling optics
- Detectors provide photon-limited sensitivities in space
- Antennas provide excellent polarization and beam-matching properties
- Modular focal plane unit for large focal plane arrays

Key Collaborators:

- Koko Megerian, Hien Nguyen, Roger O'Brient, Anthony Turner, and Alexis Weber (JPL)
- Jon Hunacek, Howard Hui, and Sinan Kefeli (Caltech)
- Chao-Lin Kuo (Stanford), Jeff Filippini (UICU)

Current Funded Period of Performance:

Jan 2014 – Dec 2015; Jan 2016 – Dec 2017

Recent Accomplishments:

- ✓ 90- and 150-GHz focal planes flew on SPIDER balloon experiment
- ✓ Fabricated 40-GHz antennas; fielded 220-GHz arrays
- ✓ Tested tapered antennas with refracting optical system
- ✓ Tested beam-line particle response to frame events in Planck device

Next Milestones:

- Test 40-GHz antenna
- Develop second-generation wide-band antenna
- Develop second-generation dual-color antenna

Applications:

- NASA Inflation Probe mission
- Explorer & international CMB missions
- Technology commonalities with Far-IR and X-Ray missions

$TRL_{In} = 3\text{-}4$ $TRL_{Current} = 3\text{-}6$ $TRL_{Target} = 4\text{-}6$