

# Planar Antenna-Coupled Superconducting Detectors for CMB Polarimetry

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## Objectives and Key Challenges:

Advance antenna-coupled superconducting detector technologies for space requirements:

- Antenna design and performance
- Propagation losses
- Develop and test modular focal plane units
- MKIDs for CMB science
- TES stability & cosmic-ray response
- Extended-frequency antennas
- Readout noise stability

## Significance of Work:

- RF propagation properties of antennas
- Detector sensitivity, stability, and minimized particle susceptibility

## Approach:

- Planar antennas provide entirely lithographed fabrication with no coupling optics
- Design scales to all bands required for Inflation Probe from 30 to 300 GHz
- Detectors provide photon-limited sensitivities in space
- Antennas provide excellent polarization and beam-matching properties
- Modular focal-plane unit for large focal plane arrays

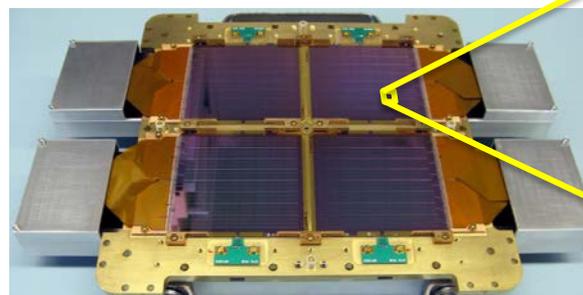
## Key Collaborators:

- Koko Megerian, Hien Nguyen, Roger O'Brient, Anthony Turner, Alexis Weber (JPL)
- Jeff Filippini, Sunil Golwala, Howard Hui, Zak Staniszewski (Caltech)
- Chao-Lin Kuo (Stanford)

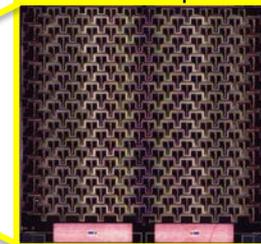
## Current Funded Period of Performance:

- October 2013 – September 2015

Sub-orbital focal plane array



Antenna-coupled TES



## Recent Accomplishments:

- ✓ Tested sample of far-field beams of tapered antennas
- ✓ 220 GHz focal planes developed and characterized
- ✓ Optimized magnetic shielding of 95 GHz focal plane module
- ✓ Characterized loss and coupling at 250 GHz

## Next Milestones:

- Flight of SPIDER for particle response demonstration (Jan 2015)
- Full test of far-field beams of tapered antennas (Mar 2015)
- 40 GHz antenna design (Feb 2015)
- Beam-tests of module in representative optics (April 2015, delayed)

## Applications:

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

$TRL_{In} = 3-4$   $TRL_{PI-Asserted} = 3-5$   $TRL_{Target} = 4-6$