High Efficiency Feedhorn-Coupled TES-based Detectors for CMB Polarization

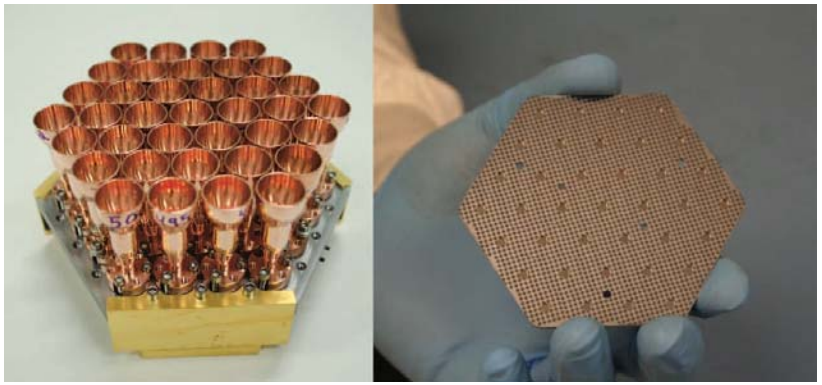
PI: Edward J. Wollack/NASA GSFC

Objectives and Key Challenges:

- Development of focal planes for characterization of CMB polarization with the following detector properties:
  - Background limited millimeter-wave polarimetric sensor with high coupling efficiency and systematic error control.
  - Inherently broadband design, scalable to large format arrays over multiple frequencies of astrophysical interest.

Significance of Work:

- Sub-orbital and space-borne operation of detectors, including
  - Improved rejection of stray light by detector architecture
  - Improved broadband performance and coupling efficiency
  - Mitigation of space environmental concerns (surface/deep dielectric charging & cosmic rays)



(left) Hyridized 90GHz Focal Plane; (right) Detector Wafer

Approach:

- The effort is focused around 3 fabrication runs to integrate the new technologies into the detector architectures. Specifically, improved:
  - Stray light mitigation and package thermalization
  - Implementation of air bridge crossovers and ground-plane contacts for large bandwidth/low loss signal routing at higher frequencies

Key Collaborators:

- K. Denis (GSFC), K. Rostem (GSFC/JHU), K. U-Yen (GSFC), S.H. Moseley (GSFC)
- D. Chuss (Villanova)
- T. Marriage, C. Bennett (JHU)

Current Funded Period of Performance:

- Start: 1/1/2016, End: 12/31/17

Recent Accomplishments:

✓ Funding received, test, and efforts initiated…

Next Milestones:

- Air bridge design and fabrication development (April 2016)
- W-band package design validation (July 2016)
- Test equipment procurement of commissioning (August 2016)
- Device bilayer development (April 2016)
- Device run #1 (August 2016)

Application:

- Cosmic Microwave Background Polarimetry, CMBpol, suborbital

$TRL_{In} = 3$ $TRL_{PI\text{-}Asserted} = 3$ $TRL_{Target} = 6$