A Far-Infrared Heterodyne Array Receiver for CII and OI Mapping

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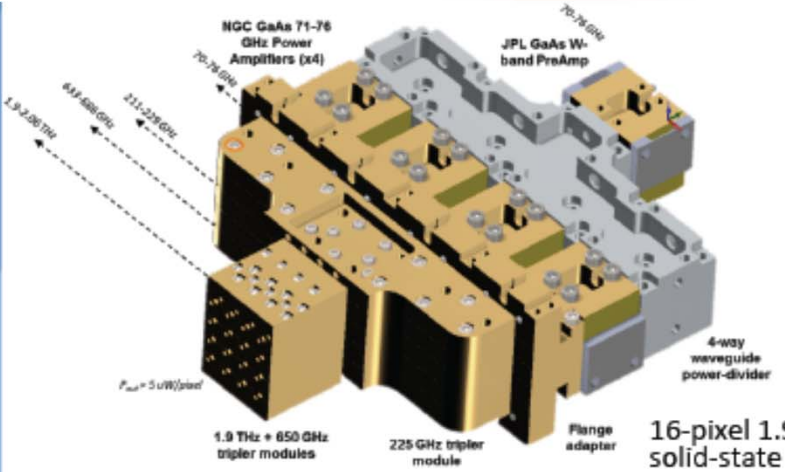
Objectives & Key Challenges:

- Heterodyne technology is necessary to answer fundamental questions such as how do stars form? How do circumstellar disks evolve and form planetary systems? What controls the mass-energy-chemical cycles within galaxies?
- We will develop a 16-pixel heterodyne receiver system to cover both the C+ and the O+ lines.

Significance of Work:

- Proposed work will advance the TRL of array receivers so that they can be deployed on airborne platforms such as SOFIA or future suborbital and space missions



16-pixel 1.9 THz all solid-state LO source

Approach:

- Use JPL-developed membrane diode process to construct tunable sources in the 1.9 - 2.06 THz range
- Use novel, waveguide-based, active-device, power-combining schemes to enhance power at these frequencies
- Design and build compact, silicon, micro-machined housing for HEB mixer chips
- Use CMOS technology for back-ends/synthesizer
- Characterize and test multi-pixel receivers to validate stability and field performance

Key Collaborators:

- Paul Goldsmith (Science Lead), Jon Kawamura, Jose Siles, Choonsup Lee, and Goutam Chattopadhyay (JPL)
- Frank Chang (UCLA)
- Sander Weinreb (Caltech)

Development Period:

- October 2013 – September 2016

Recent Accomplishments:

- ✓ Completed system architecture design and interface controls
- ✓ Designed mixer devices
- ✓ Designed multiplier devices
- ✓ Fabricated mixer devices
- ✓ Fabricate multiplier devices
- ✓ Demonstrated 4 pixel LO source at 1.9 THz
- ✓ Demonstrated 4-pixel receiver at 1.9 THz

Next Milestones:

- Assemble 4-pixel receiver with CMOS backend
- Characterize receiver sensitivity and stability
- Design 16-pixel receiver components
- Fabricate 16-pixel receiver components
- Assemble and test 16-pixel receiver

$TRL_{In} = 4$ $TRL_{Current} = 4$ $TRL_{Target} = 5$