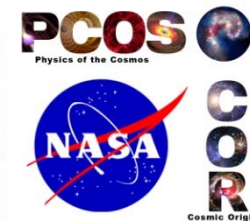


Raising the Technology Readiness of 4.7-THz local oscillators

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Objectives and Key Challenges:

- This project seeks to raise the TRL of 4.7-THz local oscillators based on THz quantum-cascade lasers.
- The key challenges are to increase the output power level from the current level of <1 mW to 5 mW, and to increase the operating temperature from a lab-demonstrated ~10 K to ~40 K that can be provided in a space-based or suborbital observatory.

Significance of Work:

- The 4.744 THz [OI] fine-structure line is the dominant cooling line of warm, dense, neutral atomic gas. Observation of this line will provide valuable information for studies of cosmic origins.
- This project will be important to the proposed GUSTO project.

Approach:

- Develop perfectly phase-matched 3rd-order DFB structures at 4.7 THz with robust single-mode operations with good beam patterns.
- Develop phase-matched 3rd-order DFB coupled with integrated antennae to increase the output power level to ~5 mW, and to increase the wall-plug power efficiency to 0.5%.

Key Collaborators:

- John L. Reno, Sandia
- J. R. Gao, SRON/Delft

Current Funded Period of Performance:

- March 1, 2016 – February 28, 2019



Array of DFB lasers at ~4.7 THz. The harmonic mixer is used to phase lock the QCL LO.

Recent Accomplishments:

- N/A

Next Milestones (by 2/28/2017):

- Complete the design of perfectly phase-matched 3rd-order DFB lasers aimed for ~4.7 THz.
- Develop a high-yield dry-etching process using ICP (inductive-coupled plasma) to achieve clean and smooth side walls with high aspect ratios.
- Grow ~3 MBE wafers based on improved QCL designs.
- Fabricate devices using a combination of dry and wet etching.

Application:

- GUSTO (The Gal/Xgal U/LDB Spectroscopic/Stratospheric THz Observatory)

TRL_{in} = 3 TRL_{current} = 3 TRL_{target} = 5