



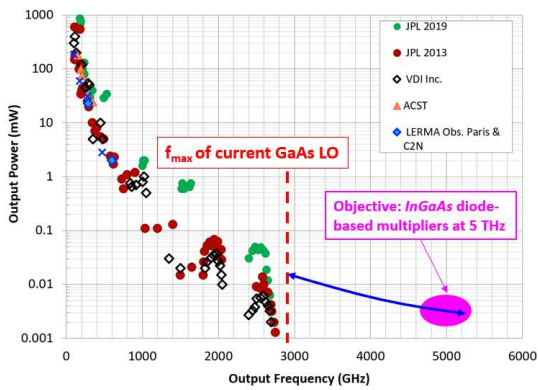
FY23 Innovative Spontaneous Concepts Research and Technology Development (ISC)

InGaAs Schottky Diode-based Local Oscillators (LO) beyond 5 THz

Principal Investigator: Choonsup Lee (386);

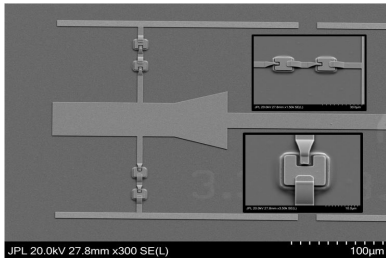
Co-Investigators: Alain Maestrini (386), David Ting (389), Imran Mehdi (386), Sam Keo (389)

1. Objectives & 2. Background:

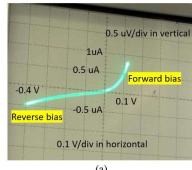


Comparison within GaAs LO sources. The goal of ISC is to design a 300 GHz LO source using the measured InGaAs diode models, while APRA aims to develop 5 THz LO sources.

3. Approach and Results:



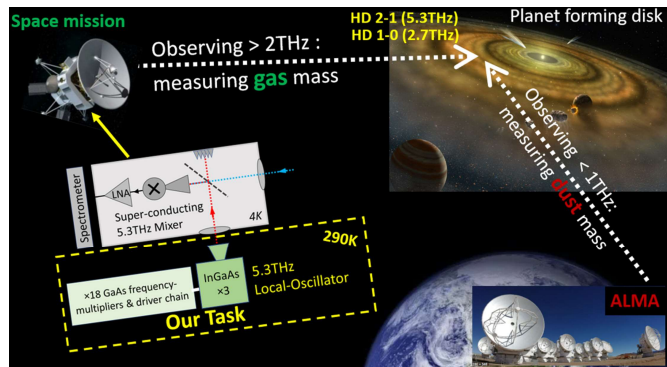
The SEM image shows the 300 GHz doubler containing four diodes. It shows the well-defined Schottky and ohmic contacts, including mesa patterns.



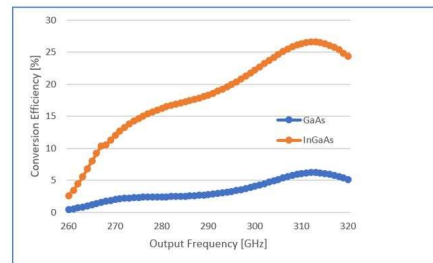
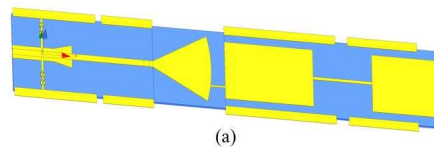
Diode Parameters	Units	GaAs diode	InGaAs diode
Isat	A	1.5e-13	1.5e-7
Vb	V	0.8	0.277
E_Gap	eV	1.43	0.75
Rs	Ohms	6.25	6.25
Eta	Unitless	1.18	1.25
Cjo	fF	19.2	19.2

The curve on the left-hand side shows the measured current-voltage plot. As expected, there is a high reverse saturation and low turn on voltage due to the narrow bandgap of InGaAs. The table on the right shows the diode models for both GaAs and InGaAs used for the 300 GHz doubler performance.

4. Significance/Benefits to JPL and NASA:



Concept of Operation. We envision coherent detectors in a space telescope to measure gases (especially HD2-1 and HD1-0) in a planet-forming disk. In contrast, ground-based telescopes can only measure dust. The proposal enables developing a coherent LO sources at 5.3 THz to build an ultra-sensitive high spectral resolution coherent receiver.



It shows the HFSS model of 300 GHz doubler and its RF simulation result. At 5 mW input power, InGaAs doubler has higher conversion efficiency by a factor of 5 compared to GaAs doubler.

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

Clearance Number: CL#00-0000
Poster Number: RPC#
Copyright 2023. All rights reserved.

Publications:

Planning to submit to IRMMW 2024 conference

PI/Task Mgr. Contact Information:

Choonsup.Lee@jpl.nasa.gov