

# 1.4 THz SIS mixer using Nb and Al tuning circuit

A. Karpov<sup>1</sup>, D. Miller<sup>1</sup>, J. A. Stern<sup>2</sup>, F. Rice<sup>1</sup>, H. G. LeDuc<sup>2</sup>, J. Zmuidzinas<sup>1,2</sup>

1 California Institute of Technology, Pasadena, CA 91125, USA,  
Email: Karpov@submm.caltech.edu

2 Jet Propulsion Laboratory, Pasadena, CA 91109, USA

## Abstract

The 1.4 THz SIS mixer is prepared for a heterodyne spectrometer CASIMIR aimed for the stratospheric observatory SOFIA. One of goals of this work is to supply a low noise spectrometer for the studies of the H<sub>2</sub>D<sup>+</sup> 101 - 000 line around 1370 GHz.

We report on the development of a new version of a THz band SIS mixer. In order to reduce the loss in the matching circuit of the mixer we are using Nb/Al microstrip circuit with the Silicon dioxide dielectric layer. The low loss in the circuit using SiO<sub>2</sub> dielectric layer should provide a significant improvement compared to the previously used mixer circuits with SiO dielectric. The mixer is using a quasi optical design in order to couple the SIS junctions with the telescope beam. The mixer chip with a planar double-slot antenna is mounted at the back side of a Silicon lens. The SIS junction normal resistance to the area product RNA is about 6 Ohm per micron square. At the target frequency of about 1.4 THz the on-chip coupling is expected to be better than 70%. With this level of the circuit loss the expected receiver noise may be close to 4-5 hv/k. The receiver design bandwidth is 1300 – 1500 GHz, about 200 GHz wide.

The mixer test with SiO and SiO<sub>2</sub> dielectric in the circuit will be reported.

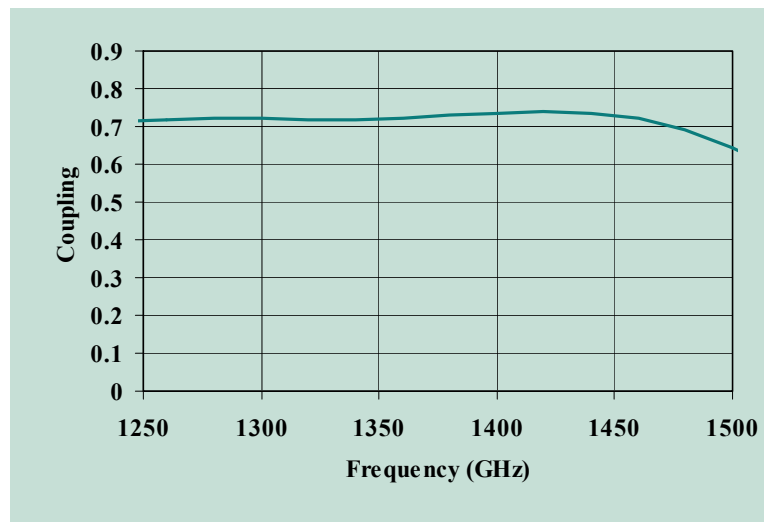


Figure 1. The expected SIS mixer coupling to the signal source in the 1.3-1.5 THz range is better than 70%.