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Broadband SIS mixer for 1 THz band

A. Karpov[1], D. Miller[1], J. A. Stern[2], B. Bumble[2], H. G. LeDuc[2], J. Zmuidzinas[1,2]
*1 California Institute of Technology, Pasadena, CA 91125, USA *,*
2 Jet Propulsion Laboratory, Pasadena, CA 91109, USA
* Contact: Karpov@submm.caltech.edu,
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***Abstract*— We report the development of a low noise and broadband SIS mixer aimed for 1 THz channel of the Caltech Airborne Submillimeter Interstellar Medium Investigations Receiver (CASIMIR), designed for the Stratospheric Observatory for Far Infrared Astronomy, (SOFIA). The mixer uses an array of 0.24 μm2 Nb/Al-AlN/NbTiN SIS junctions with critical current density of 30-50 KA/cm2. The junctions are shaped in order to optimize the suppression of the Josephson DC currents. We are using a double slot planar antenna to couple the mixer chip with the telescope beam. The RF matching microcircuit is made using Nb and gold films. The mixer IF circuit is designed to cover 4 - 8 GHz band. A test receiver with the new mixer has a low noise operation in a 0.87 – 1.12 THz band. The minimum DSB receiver noise measured at 1 THz is 260 K (Y=1.64), apparently the lowest reported up to date. The receiver noise corrected for the loss in the LO injection beam splitter and in the cryostat window is 200 K. The combination of a broad operation band of about 250 GHz with a low receiver noise is making the new mixer a useful element for application at SOFIA. We will discuss the prospective of a further improvement of the sensitivity and extension of the upper frequency of operation of SIS mixer.**