

Low noise SIS mixer with Nb tuning circuit for the frequency above 1 THz

A. Karpov, J. Zmuidzinas, F. Rice, D. Miller
J. A. Stern*, B. Bumble*, H. G. LeDuc*

California Institute of Technology, Pasadena, CA 91125, USA

* Jet Propulsion Laboratory, Pasadena, CA 91109, USA

We developed a SIS mixer for the 1.1-1.25 THz band of the heterodyne receiver of Herschel space observatory. The quasi-optical SIS mixer has two NbN/AlN/Nb junctions with the critical current 30-50 kA/cm² and the gap voltage of 3.4 mV. The tuning circuit integrated with SIS junction has the base electrode of Nb and a gold wire layer. This approach simplifies the SIS junction technology, compared to a design using NbTiN base electrode. The junction base electrode and the ground of the tuning micro strip circuit are formed in one step. The frequency of operation of the mixer is well above the gap frequency of Nb, and it behaves here as a normal metal. The epitaxial Nb film is grown at the sapphire substrate. The resistivity of Nb at the critical temperature of 0.2 $\mu\Omega$ cm is below the resistivity of the best normal metal films. This allows us to expect the loss of only 2 dB in the junction tuning circuit at 1.2 THz. The measured receiver noise temperature is below 600 K.

