

Low noise SIS mixer for the band 1.1-1.25 THz of the Herschel space radiotelescope

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We report a further progress in development of SIS mixer for the 1.1-1.25 THz band of the heterodyne spectrometer of Herschel space observatory. The corrected receiver noise with the new mixer is close to 500 K with detection in entire 4-8 GHz IF band.

The quasi-optical SIS mixer has two Nb/AlN/NbN with the area of $0.25 \mu\text{m}^2$. The Josephson critical current density in the junction is $30\text{-}50 \text{ kA}/\text{cm}^2$. 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 measured mixer beam pattern is symmetrical and, in a good agreement with the design requirements, the $f/d = 4.2$. The receiver Y factor is measured in experiment with an ambient temperature and a liquid Nitrogen cooled loads. The maximum Y is about 1.26 at bias voltage about 2 mV. The receiver uncorrected DSB noise temperature is 750 K. A further experiment with the aim to reduce the loss in the mixer circuit at THz frequency by 30-60 % is under way.

