

1.4 THz SIS mixer development for radio astronomy

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We report the development of a 1.4 THz SIS mixer for a heterodyne spectrometer CASIMIR aimed for the stratospheric observatory SOFIA. The goal of this work is to provide a low noise spectrometer particularly for the studies of the H_2D^+ $1_{01} - 0_{00}$ line around 1370 GHz.

In the mixer we use two Nb/AlN/NbTiN SIS junction array. The mixer has a quasi-optical design. The maximum frequency of an SIS mixer operation is close to the double gap frequency, about 1.7 THz for the hybrid Nb – NbTiN junctions having the gap voltage of 3.4-3.5 mV. This allows one to cover a significant part of the THz range with already existing SIS technology.

The LO power requirements for the designed SIS mixer are low. Based on our experience at 1.25 THz, the mixer uses about 100 – 150 nW of LO power when optimally pumped. The currently available LO sources are providing about 10 uW power, sufficient for the LO injection through a diplexer.

The SIS mixer model envisages 1.2-1.5 THz coverage with a low noise operation. In the figure below are the predictions for the on-chip SIS mixer coupling to the signal source.

The calculation gives the coupling in the 1.4 THz device only slightly less than in the 1.2 THz mixer, already proved to perform well.

The receiver test at 1.33 – 1.35 THz gives promising results for a complete receiver operation. We will discuss the limitations of the mixer performance at 1.4 THz.

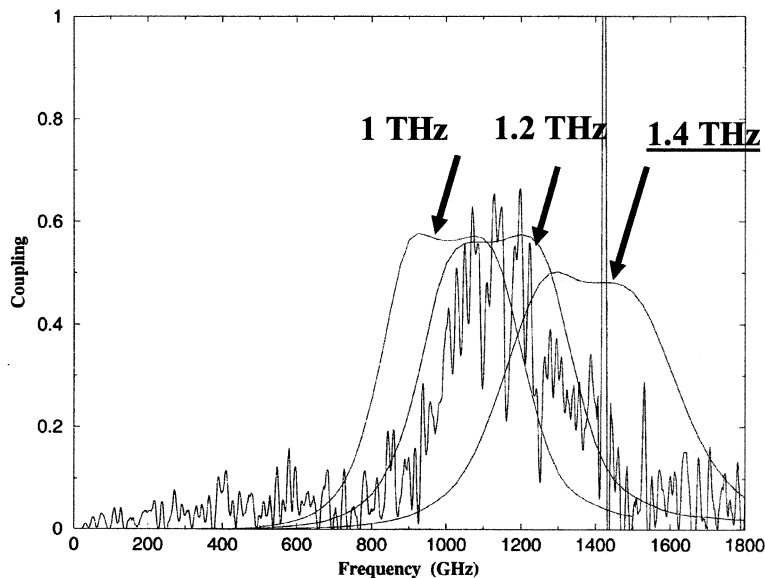


Fig. 1. Prediction of the on-chip coupling in 1 – 1.5 THz SIS mixers.

