NIOBIUM SUPERCONDUCTING DIFFUSION-COOLED HOT-ELECTRON BOLOMETER MIXERS ABOVE 1 THz

A. Skalare, W. R. McGrath, B. Bumble, H. G. LeDuc
Center for Space Microelectronics Technology, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

P. J. Burke, R. J. Schoelkopf, D. E. Prober
Dept. of Applied Physics, Yale University, New Haven, CT 06.520-8482

Superconducting hot-electron bolometers are a promising option for low noise heterodyne detector systems at frequencies above 1 THz. Since the mixing process in these devices relies on heating of the electron gas, they do not suffer from the upper frequency limitation set by the superconducting energy gap, as is the case for SIS mixers, They are also much faster than more conventional bolometers, such as those made from indium antimonide, and can therefore operate with intermediate frequencies of several GHz. This combination of useful properties make superconducting hot-electron bolometers ideal candidates for 111o]cc11]w" spectroscopy in the fields of astrophysics and atmospheric chemistry. The heterodyne performance of this device is expected to be independent of frequency up to several tens of THz. While recent measurements have shown excellent performance at ~0.5 THz[1], our current experiments are designed to test this prediction above 1 THz.

We report on initial mixing experiments at 1.2 THz using a diffusion-cooled superconducting niobium hot-electron bolometer in an open-structure quasioptical double-dipole antenna. The bolometer is an approximately 0.3 μm long and *0.1* μm wide strip of niobium that is contacted at both ends by normal metal (gold) pads. The device chip is attached to a quartz lens that is used to focus the RF signal and local oscillator (LO) power onto the detector antenna. The LO is generated by a submillimeter wave methanol laser, and is coupled into the signal path by a mylar beamsplitter. The beamsplitter and 77 K and 300 K signal loads are mounted inside an evacuated box, which allows Y-factor measurements to be made without any adverse effects from atmospheric absorption. Noise temperature, conversion efficiency and LO power measurements will be discussed.

The research described in this paper was performed by the Center for Space Microelectronics Technology, Jet Propulsion Laboratory, California institute of Technology, and by Yale University, and was jointly sponsored by the National Aeronautics and Space. Administration, office of Spat.c Access and Technology, and by the National Science Foundation.

[1] Skalare, McGrath, Bumble, LeDuc, Burke, Verheijen, Schoelkopf, Prober, to be published in *Applied Physics Letters*