

A HEB Waveguide Mixer Operating with a Waveguide QCL at 1.9 THz

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We present results of heterodyne measurements at 1.9 THz using a hot electron bolometer (HEB) waveguide mixer with a waveguide quantum cascade laser (QCL) and with a commercial solid-state multiplier as local oscillator (LO).

The HEB mixer is similar to the currently operating in the upGREAT low frequency array on the Stratospheric Observatory for Infrared Astronomy (SOFIA). The HEB mixer devices employ NbN microbridges integrated into an on-chip matching circuit with a waveguide probe antenna. The circuit is defined on a 2 μm thick Si membrane and is suspended and contacted with beamleads. The device is assembled into a 48 μm by 96 μm rectangular metal waveguide and uses a waveguide spline profile feedhorn (commercial) as an interface to free space. The 1.9 THz QCL is a double metal QCL, which is embedded in a waveguide with a broadband coupling structure and radiates to free space with an integrated diagonal feedhorn. The QCL operates at an ambient temperature of 12 K.

In a standard heterodyne measurement setup with a Mylar beam splitter, system noise temperatures between 700 K and 1500 K are measured over a 0.2-4 GHz IF bandwidth. We study the performance of both types of LOs and their impact on the measured receiver noise performance.

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