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Millimeter and sub-millimeter heterodyne mixing based on 2DEG hot-electron bolometers KAI WANG, University at Buffalo, the State University of New York, Amherst, NY, 14260, MATTHEW BELL, RAHUL RAMASWAMY, ANDREI SERGEEV, GOTTFRIED STRASSER, VLADIMIR MITIN, University at Buffalo, the State University of New York, Amherst, NY, 14260 — We investigate GHz and THz heterodyne mixer based on the electron heating effect of a two-dimensional electron gas (2DEG) by electromagnetic radiation at liquid nitrogen temperatures (77K). The devices are fabricated from AlGaAs/GaAs heterostructures with a channel width of 150 μm and lengths varying from 3-20 μm. Steady-state measurements are used to investigate electron heating in these devices and determine basic parameters, such as electron-phonon energy relaxation time and electron heat capacity. We perform mixing experiments at $\sim$100 GHz frequency range with two Gunn diodes as the radiation sources, and find that electron heating is the primary mixing mechanism at these frequencies. For the mixing experiments at $\sim$ 2 terahertz range, a quantum cascade laser (QCL) is employed as the local oscillator. To optimize our device, we also investigate electron kinetics and transport properties in the 2DEG hot-electron bolometer.

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