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Title:Hot-electron bolometer mixers for terahertz radiation
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Abstract:Hot-electron bolometer (HEB) mixers are used in many low noise heterodyne radio astronomical receivers. Their noise temperature is at the level of 10-15 times the quantum limit, and their gain bandwidth is from 2GHz to slightly more than 5GHz depending on the type of substrate material used for a device fabrication. The HEB mixers presented in this Letter are a complex multilayer thin-film structure containing an ultra-thin superconducting film of NbN as a detecting element, and a thick normal metal layer as an antenna structure. The overall performance of the device has been improved by optimisation of the HEB mixer fabrication steps starting with ultra-thin NbN films, followed by NbN/Au bi-layers for antenna structures. Patterning was achieved using electron-beam lithography and lift-off processes. The noise temperature of the HEB mixer fabricated with the improved technology is about 800 K, as measured in a cryogenic-free system with a quantum cascade laser as a local oscillator.
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