Analysis of NbN Hot Electron Bolometer Receiver Noise Temperatures above 2 THz with a Quantum Noise Model

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Abstract — This paper summarizes our receiver noise temperature data of NbN HEB mixers obtained at a number of local oscillator frequencies between 1.9 to 4.3 THz in order to verify the role of quantum noise. The experimental data show that the receiver noise temperature increases roughly linearly with frequency. At 4.3 THz, we measured a receiver noise temperature of 1300 K, which is about 6 times (hf/k_B). The noise data at different frequencies are compared to a prediction of a noise model including the contribution of quantum noise and making use of a hot-spot model for mixing. We draw a preliminary conclusion that at 4.3 THz roughly 30% of the total receiver noise temperature can be ascribed to the quantum noise. However, more dedicated measurements are required in order to further support the quantum noise model for HEB mixers.

Index Terms — heterodyne receiver, superconducting hot electron bolometer mixer, THz mixer, terahertz, quantum noise

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