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Ultrasensitive Microwave Bolometer

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Intense development of nanobolometers has taken place for well more than a decade with the aim to reach noise equivalent power NEP = 10e-20 W/rtHz. Furthermore, observation of single photons at increasingly long wavelengths is a long-standing effort. We present a microwave nanobolometer based on superconductor/normal-metal/superconductor Josephson junctions. Using positive electrothermal feedback, we show that we can achieve a single-shot detection fidelity of 0.56 for 1.1-zJ pulses of 8.4-GHz photons [1]. This is more than an order of magnitude improvement over the previous thermal detectors. Furthermore, we observe that we can reach NEP = 2*10e-20 W/rtHz with our detector in the linear bolometric mode [2]. The measured frequency dependence of the NEP suggest that this bolometer is capable of detecting single 0.3-zJ photons. These results were achieved by integrating the bolometer with a quantum-limited Josephson parameteric apmlier and further improvements are expected for example using two-dimensional materials.

[1] J. Govenius, R. E. Lake, K. Y. Tan, and M. Möttönen, Phys. Rev. Lett. 117, 030802 (2016).

[2] R. Kokkoniemi et al., arXiv:1806.09397 (2018).

Less than 5 years of experience since completion of Ph.D

N

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