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Thermal relaxation and kinetic inductance in superconducting nanowires used as single photon detectors ANTHONY ANNUNZIATA, DANIEL SANTAVICCA, JOEL CHUDOW, Dept. of Applied Physics, Yale University, ORLANDO QURANTA, University of Salerno, LUIGI FRUNZIO, Dept. of Applied Physics, Yale University, AVIAD FRYDMAN, Dept. of Physics, Bar Ilan University, MICHAEL ROOKS, Institute for Nanoscience and Quantum Engineering, Yale University, DANIEL PROBER, Dept. of Applied Physics, Yale University — As many groups have shown, superconducting nanowires can be used as high count rate single-photon detectors for visible and infrared photons. We study thermal relaxation in Nb nanowires following the absorption of a single-photon using a combination of experiments and numerical modeling. Experiments for Nb agree well with numerical predictions. We compare these results to measurements of NbN nanowires by us as well as other groups. Our studies highlight the roles of the different material and readout-circuit parameters. Our model suggests that in Nb, slow thermal relaxation of the electron system significantly limits the detector reset time. We also study the temperature and bias current dependence of the kinetic inductance of NbN nanowires over a large range of current and temperature. We find that the current dependence deviates significantly from what is expected from the Ginzburg-Landau theory even when measured close to the critical temperature. This work is supported by NSF - EPDT, NSF – Graduate Research Fellowship, and IBM research.

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