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Detection and Reset Dynamics of Superconducting Nanowire Single Photon Detectors[1] ANTHONY ANNUNZIATA, Yale University, ORLANDO QUARANTA, University of Salerno, DANIEL SANTAVICCA, JOEL CHUDOW, LUIGI FRUNZIO, Yale University, AVIAD FRYDMAN, Bar Ilan University, MICHAEL ROOKS, Yale University and IBM Research, DANIEL PROBER, Yale University — We investigate the single photon detection and reset mechanisms in superconducting nanowires, which have received recent, widespread attention for use in applications requiring fast optical and near infrared photon counting. These devices are fabricated from ultra-thin Nb and NbN films and read out by measuring short ($\sim$1 ns) transient voltage spikes that result from the localized suppression of superconductivity by an absorbed photon. We find that intrinsic electro-thermal instabilities necessitate a low impedance ($<$50 ohms) readout circuit for stable resetting to the superconducting state after detecting a photon. The actual impedance needed depends on the detailed physical properties of the device. We also investigate the detection mechanism and report the dependence of detection efficiency on the temperature and dc bias current as well as on film disorder, from which we present a model of the detection mechanism.

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