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Optical coupling to nanoscale superconducting transition edge sensors for GHz count rate near-IR single-photon detection FAUSTIN CARTER, DANIEL SANTAVICCA, DANIEL PROBER, Yale University — Detection of individual near-IR photons with GHz count rates, good timing resolution, and high quantum efficiency is important in a number of applications. These include quantum key distribution, single-photon classical communication, and CMOS imaging for defect analysis. We propose a nano-scale superconducting niobium transition edge sensor (TES). The extremely small detector volume allows for single-photon sensitivity at 4 K, with a much faster response time (nsec) than conventional TES detectors operating below 0.4 K. The proposed device is intrinsically photon number resolving, unlike a superconducting nanowire single-photon detector or an avalanche photodiode. Efficient photon coupling is achieved with a resonant near-IR planar antenna. This is non-trivial in the near-IR regime. We present numerical simulations of the optical coupling for such a device.

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