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Quantum efficiency of a single microwave photon detector based on a current-biased Josephson junction[1] AMRIT POUDEL, ROBERT MCDERMOTT, MAXIM VAVILOV, University of Wisconsin-Madison — We analyze the quantum efficiency of a single microwave photon detector based on a current-biased Josephson junction. We consider the Jaynes-Cummings Hamiltonian to describe coupling between the photon field and the junction. We then take into account coupling of the junction and the resonator to the environment. Numerically solving the equation of motion of the density matrix of the resonator-junction system, we compute the quantum efficiency of the photon detector as a function of detection time, bias current and the junction's decay time. For current-biased Josephson junctions, the efficiency to detect a single photon with frequency in the microwave regime is around 50%. Our results also indicate that a highly efficient single microwave photon detector is feasible for a moderate improvement in the junction's decay time.

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