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Quantum metamaterial for nondestructive microwave photon detection

Friday, 21 February 2020 18:00 (30 minutes)

Detecting traveling photons is an essential primitive for many quantum information processing tasks. We propose a single-photon detector operating in the microwave domain based on a nonlinear metamaterial built from a large number of coupled Josephson junctions. By trading local nonlinearity for large spatial extent, this approach allows for a large detection bandwidth. Using numerical simulations based on many-body physics methods, we show that the single-photon detection fidelity increases with the length of the metamaterial to approaches one. The photon is not destroyed and the photon wavepacket is only minimally disturbed by the detection, in stark contrast to conventional photon detectors operating in the optical domain. The proposed detector thus offers new possibilities for quantum information processing with superconducting qubits, as well as fundamentally new experiments exploring single-photon physics and phenomenology.

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