Microwave Photon to Electron Conversion Using a High Impedance Quantum Circuit

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Résumé

We realize a microwave photon to electron converter in which a superconducting tunnel junction acts as a voltage tuneable quantum absorber through the photon-assisted tunneling of quasiparticles. We use granular aluminium to build a high impedance microwave Fabry-Pérot cavity strongly coupled to a superconducting tunnel junction. The engineered cavity mode has properties set by the finite impedance mismatch between a transmission line and the cavity on one side and by the tunnel junction on the other. By adjusting the dc-voltage applied to the junction, we tune the photon-assisted quantum tunnelling conversion rate to the microwave coupling rate of the resonator on the other side. At this critical coupling, microwave photons are efficiently harvested and continuously converted into a flow of electrons across the junction. The quantum efficiency estimated from the measured photo-assisted current approaches unity. Such experimental development paves the way towards high efficiency single microwave photon detection using charge detection techniques.

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