Superconducting microresonators for photon detection

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The absorption of photons in a superconducting film breaks apart Cooper pairs and produces single-electron (quasiparticle) excitations, which may be detected using a lithographed resonator to obtain a sensitive measurement of the superconductor's surface impedance. This concept, under investigation at Caltech/JPL since 1999, provides the basis for sensitive, frequency-multiplexed detector arrays that are relatively simple to fabricate. Several methods are available for coupling the photon energy into the resonator, allowing operation from millimeter to X-ray wavelengths. At present, a prototype submillimeter multicolor array camera is being prepared for demonstration at the Caltech Submillimeter Observatory. The noise properties of the resonators have been studied carefully and should allow background-limited detection. Superconducting microresonators are now finding other applications, e.g. quantum computing experiments.