Superconducting microresonators for photon detection

J. Zmuidzinas, P. K. Day, J. Gao, J. Glenn, S. Golwala, S. Kumar, H. G. LeDuc,
B. A. Mazin, J. Schlaerth, and A. Vayonakis

California Institute of Technology, Pasadena, CA

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.