Title:
Superconducting Microresonators for Detection and Multiplexing

Author:
Jonas Zmuidzinas
Caltech and the Jet Propulsion Laboratory

Abstract:
Superconducting microresonators are drawing increasing attention for use in sensitive THz detection, especially for astronomical applications. These are relatively simple thin-film lithographically produced devices that are amenable to large-scale microwave frequency multiplexing. Indeed, such resonators have very high quality factors, in the range 10^4 to 10^6, potentially allowing 10^3 to 10^4 resonators to be multiplexed using a single cryogenic low-noise amplifier (HEMT). The resonators may themselves serve as detectors given appropriate coupling of the signal energy, or the resonators may be used to multiplex a broad range of other devices such as SIN or SIS tunnel junction detectors, SQUID preamplifiers for TES bolometers, etc. One of the major advantages of microwave frequency multiplexing is that much of the complexity of the readout system is transferred to room temperature, where it is now feasible to produce readouts with very high channel counts using FPGA digital signal processing along with fast, high-resolution ADCs and DACs. This presentation will give an overview of the topics described above, including an introduction to the basic physics of superconducting microresonators and their noise mechanisms, and as a concrete example will describe the development of a 2.5 kilopixel millimeter-wave multicolor camera system for the Caltech Submillimeter Observatory.