Antenna-coupled Microwave Kinetic Inductance detectors (MKIDs) for mm and submm imaging arrays.

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We present results from completely lithographic antenna-coupled Microwave Kinetic Inductance detectors (MKIDs). MKIDs are superconducting resonators with resonant frequency and quality-factor which are highly sensitive to changes in the density of the quasiparticle population which occurs when photons above the superconducting gap energy are absorbed. The resonators are coupled to submm light through on-chip phased-array slot antennas. Each planar antenna consists of an array of N long slots which are fed along their length at M points. The resulting N*M feed points are combined in-phase using a binary summing tree made of low-loss superconducting microstrip lines. Due to its large size, the resulting planar antenna produces a narrow beam pattern and can therefore be used without additional optical coupling elements such as feedhorns or substrate lenses. The output of the antenna is a single superconducting thin-film microstrip line which can be efficiently coupled to one (or more) kinetic inductance coplanar waveguide resonators to produce a single (or multi-color) pixel in an imaging focal plane array, using in-line lumped element lithographic band-pass filters. Such highly integrated architectures can be easily fabricated on a single substrate, and many detectors can be frequency multiplexed through coupling to a single feedline. Microwave readout provides a lot of bandwidth per detector, allowing a large number of pixels to be read using a single cryogenic microwave amplifier and warm readout electronics.

We show results from a demonstration camera (DemoCam) using MKIDs. This camera features 16 planar antennas on its focal plane, each feeding two MKID resonators through in-line bandpass filters with bands centered at 240 GHz and 350 GHz.