Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Kinetic inductance parametric up-converter ADITYA KHER, California Institute of Technology, PETER DAY, NASA Jet Propulsion Laboratory, BYEONG HO EOM, JONAS ZMUIDZINAS, California Institute of Technology, H. G. LEDUC, NASA Jet Propulsion Laboratory — We describe a novel class of devices based on the nonlinearity of the kinetic inductance of a superconducting thin film. By placing a current-dependent inductance in a microwave resonator, small currents can be measured through their effect on the resonator's frequency. By using a high-resistivity material for the film and nanowires as kinetic inductors, we can achieve a large coefficient of nonlinearity to improve device sensitivity. We demonstrate a current sensitivity of 8 pA/Hz$^{1/2}$, making this device useful for transition edge sensor readout and other cutting-edge applications. An advantage of these devices is their natural ability to be multiplexed in the frequency domain, enabling large detector arrays for TES-based instruments. A traveling-wave version of the device, consisting of a thin-film microwave transmission line, is also sensitive to small currents as they change the phase length of the line due to their effect on its inductance. We demonstrate a current sensitivity of 5 pA/Hz$^{1/2}$ for this version of the device, making it also suitable for TES readout and other applications. It has the advantage of multi-GHz bandwidth and greater dynamic range, offering a different approach to the resonator version of the device.

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Date submitted: 13 Jan 2016 Electronic form version 1.4