DIPARTIMENTO DI FISICA "GIUSEPPE OCCHIALINI"
WPASM5
5th Workshop on the Physics and Applications of Superconducting Microresonators

Contribution ID: **5** Type: **Oral Contribution**

Responsivity and electrothermal feedback in Kinetic Inductance Detectors

Wednesday, 22 June 2016 14:50 (25 minutes)

We review and present simulations of our complete (large-signal, small-signal, and noise) electrothermal model of Kinetic Inductance Detectors [1]. Our geometry-independent model includes both the behaviour of the microwave resonator as well as the heat capacities of and thermal conductances between the superconductor quasiparticles, superconductor phonons, substrate phonons, and thermal bath. Using our previous results on microwave readout power heating, we quantify the electrothermal feedback due to the dependence of readout power absorbed on quasiparticle effective temperature.
With this model we calculate the large-signal, small-signal, and noise dynamical behaviour of KIDs, in particular the changes in mixer I and Q output due to signal power, for a range of device operating parameters including varying thermal isolation from the bath. We use this to find optimal operating points for detection of signal power as measured by responsivity and NEP, including combinations of I and Q channel readout, for both symmetric and highly asymmetric resonance curves. We also discuss how the electrothermal feedback affects responsivity and NEP, and how changes to the thermal configuration are related to the response time of the detector and noise measured in the detector output. We briefly comment on how the model can be use to analyse the behaviour of KIDs operating in a phonon detection mode.

[1] Thomas, C. N., Withington, S. & Goldie, D. J. Electrothermal model of kinetic inductance detectors. Supercond. Sci. Technol. 28, 045012 (2015).

Primary author: Mr GURUSWAMY, Tejas (University of Cambridge)

Co-authors: Dr THOMAS, Chris (University of Cambridge); Dr GOLDIE, David (University of Cambridge); Prof. WITHINGTON, Stafford (University of Cambridge)

Presenter: Mr GURUSWAMY, Tejas (University of Cambridge)

Session Classification: Session 1: MKIDs for optical, infrared, and millimeter wave telescopes - Part 2

Track Classification: Physical effects in superconducting microresonators