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A Microfabricated Phonon Spectrometer to Spectrally Resolve Phonon Transport OBAFEMI OTELAJA, JARED HERTZBERG, RICHARD ROBINSON, Cornell University, Department of Materials Science and Engineering — In this work we show how frequency-dependent phonon transport can be probed with non-equilibrium phonons. We demonstrate a method of generating and detecting non-equilibrium phonons in micron- and nanoscale structures [1]. Our scalable method of fabricating phonon generators and detectors involves formation of Al-AlxOy-Al superconducting tunnel junctions on the sidewalls of a silicon mesa. In the line-of-sight path in these mesas, we generate and detect non-equilibrium, ballistically propagating phonons with a frequency $\sim$ 100 GHz. Phonons are generated through the decay of quasiparticles injected into one superconducting film of the generator. This process excites phonons in a tunable, non-thermal spectral distribution. The phonons radiate into the mesa and are observed by the detector after passing through the mesa. By utilizing electron-beam lithography and plasma etching, we demonstrate the fabrication of high aspect ratio nanostructures along the ballistic path in order to observe surface scattering effects. This work is supported by DOE (DE-SC0001086).

[1] J. B. Hertzberg et al, Rev. Sci. Instrum. 82, 104905 (2011).

[X] Prefer Oral Session
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