Abstract Submitted
for the NWS14 Meeting of
The American Physical Society

Vibrating vortices as a probe of superconductivity[1] NATALIE MURPHY, XIAOQING ZHOU, ERIC THEWALT, WENDELL HUTTEMA, COLIN TRUNCIK, KEVIN MORSE, Simon Fraser University, JOHN SARRAO, Los Alamos Natl. Lab., DAVID BROUN, Simon Fraser University — A characteristic property of ordered phases of matter is the spectrum of quasiparticle excitations they support at low energies. Examples include phonons in crystals, rotons in superfluid ^{4}He, and Bogoliubov quasiparticles in BCS-type superfluids such as ^{3}He and metallic superconductors. In the case of superfluid ^{3}He, a set of particularly beautiful experiments by the Lancaster group used vibrating wire resonators to probe the quasiparticle spectrum. In short, the dynamics of the vibrating wire are modified by their interaction with the surrounding quasiparticle gas, and are detected electrically. We have developed an analogous technique for studying quasiparticles in superconductors, with the vibrating wire replaced by superconducting vortices oscillating at microwave frequencies. The key discovery that allows the technique to work is that, in certain unconventional superconductors, the vortex core contains very few states - the dynamics of the moving vortex instead are dominated by its interactions with the gas of extended quasiparticle states in which it is embedded. I will establish the validity of technique using data on high temperature superconductors, and then show how it can be used to obtain new physics in the heavy fermion superconductor $CeCoIn_5$.

[1]Financial support from the Natural Sciences and Engineering Research Council of Canada (NSERC) is gratefully acknowledged.

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Date submitted: 21 Mar 2014 Electronic form version 1.4