Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

High Frequency Sound in a Unitary Fermi Gas SASCHA HOINKA, CARLOS KUHN, IVAN HERRERA, PAUL DYKE, FLEET ARC Centre of Excellence, Centre for Quantum and Optical Sciences, Swinburne University of Technology, Melbourne 3122, Australia, JAMI KINNUNEN, Department of Applied Physics, Aalto University, FI-00076 Aalto, Finland, GEORG BRUUN, Department of Physics and Astronomy, University of Aarhus, Aarhus C, Denmark, CHRIS VALE, FLEET ARC Centre of Excellence, Centre for Quantum and Optical Sciences, Swinburne University of Technology, Melbourne 3122, Australia — We present an experimental and theoretical study of the phonon mode in a unitary Fermi gas. Using two-photon Bragg spectroscopy, we measure excitation spectra at a momentum of approximately half the Fermi momentum, both above and below the superfluid critical temperature T_c. Below T_c, the dominant excitation is the Bogoliubov-Anderson (BA) phonon mode, driven by gradients in the phase of the superfluid order parameter. The temperature dependence of the BA phonon is consistent with a theoretical model based on the quasiparticle random phase approximation in which the dominant damping mechanism is via collisions with thermally excited quasiparticles. As the temperature is increased above T_c, the phonon evolves into a strongly damped collisional mode, accompanied by an abrupt increase in spectral width. Our study reveals strong similarities between sound propagation in the unitary Fermi gas and liquid helium.

Sascha Hoinka
Swinburne University of Technology

Date submitted: 31 Jan 2020 Electronic form version 1.4