Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Temperature dependence of low-lying excitiations in a unitary Fermi gas[1] CHRISTOPHER VALE, CARLOS KUHN, SASCHA HOINKA, PAUL DYKE, IVAN HERRERA, Swinburne Univ of Tech, JAMI KINNUNEN, Aalto University, GEORG BRUUN, Aarhus University — Low-lying excitations are central to understanding the physical properties of many-body quantum systems. Here, we use two-photon Bragg spectroscopy to probe the elementary excitations in a unitary Fermi gas as a function of the temperature. At a momentum of approximately half the Fermi momentum, the Bragg spectra show dramatic changes across the superfluid to normal fluid transition. Below the transition temperature T_c, the dominant excitation is the Bogoliubov-Anderson phonon whose amplitude and width have a temperature dependence consistent with a theoretical model based on the quasiparticle random phase approximation. This indicates the dominant damping mechanism for phonons in the temperature range $0.5 < T/T_c < 1$ is via collisions with fermionic quasi-particles. Above the superfluid transition, the excitation spectra become much broader lying in the cross-over between zero and first sound.

[1]ARC Centre of Excellence, FLEET

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Date submitted: 31 Jan 2019 Electronic form version 1.4