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Low-lying excitations in a strongly interacting Fermi gas CHRISTOPHER VALE, SASCHA HOINKA, PAUL DYKE, MARCUS LINGHAM, Swinburne Univ of Tech — We present measurements of the low-lying excitation spectrum of a strongly interacting Fermi gas across the Bardeen-Cooper-Schrieffer (BCS) to Bose-Einstein condensate (BEC) crossover using Bragg spectroscopy. By focussing the Bragg lasers onto the central volume of the cloud we can probe atoms at near-uniform density allowing measurement of the homogeneous density-density response function. The Bragg wavevector is set to be approximately half of the Fermi wavevector to probe the collective response. Below the superfluid transition temperature the Bragg spectra dominated by the Bogoliubov-Anderson phonon mode. Single particle excitations become visible at energies greater than twice the pairing gap. As interactions are tuned from the BCS to BEC regime the phonon and single particle modes separate apart and both the pairing gap and speed of sound can be directly read off in certain regions of the crossover. Single particle pair-breaking excitations become heavily suppressed as interactions are tuned from the BCS to BEC regimes.

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