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The critical velocity in the BEC-BCS crossover JONAS SIEGL, WOLF WEIMER, KAI MORGENER, KLAUS HUECK, NICLAS LUICK, HENNING MORITZ, Univ Hamburg — Ultracold fermionic gases are an ideal model system for the study of quantum many-body phenomena. Of particular interest is superfluidity due to the open questions surrounding high-temperature superconductors in solids. One hallmark property of superfluid systems is the critical velocity below which obstacles can move through the fluid without friction. The broad Feshbach resonance of fermionic 6Li quantum gases provides the unique possibility to investigate superfluidity over a wide range of interactions. We stir the gas with a red-detuned laser beam as a local density perturbation. Above the critical velocity heating can be observed. We present high-precision measurements of the critical velocity in the BEC-BCS crossover. Our measurements are in excellent agreement with theoretical predictions for the nature of the excitations ranging from Bogoliubov sound waves in the BEC regime to Cooper pair breaking in the BCS regime. Additionally, we can transfer the three-dimensional 6Li gas to a single layer of a blue-detuned one-dimensional optical lattice. This opens the opportunity to study superfluidity in two-dimensional strongly interacting Fermi gases.

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