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Universal properties of Fermi gases near a Feshbach resonance

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A resonantly-interacting degenerate gas of Fermi atoms provides a paradigm for strong interactions and impacts several disciplines, including condensed matter physics (high-temperature superconductivity), nuclear physics (universal interactions, quark-gluon plasma), high-energy physics (effective theories of strong interactions), and astrophysics (neutron stars). A feature common to all of these systems is that spin-up and spin-down particles "strongly" interact, i.e., the zero-energy scattering length far exceeds the interparticle spacing. The atomic gas is an extremely flexible experimental system: Thanks to the Feshbach resonance phenomenon, the scattering length can be tuned to any value simply by applying an external magnetic field. I will describe experiments that focus on two phenomena stemming from strong interactions: (i) high-temperature superfluidity and (ii) universality, in which the system becomes independent of the microscopic details of the interaction. These phenomena are probed by studying the fundamental thermodynamics and mechanical properties of an optically trapped gas of fermionic lithium-6.