

## **A Little Big Bang: Strong Interactions in Ultracold Fermi Gases**

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Fermions, particles with half-integer spin such as electrons, protons and neutrons, are the building blocks of matter. When fermions strongly interact, complex behavior emerges that is often difficult to understand theoretically, for example in high-temperature superconductors, neutron stars or the quark-gluon plasma of the early universe.

Ultracold Fermi gases of atoms are a new type of strongly interacting fermionic matter that can be created and studied in the laboratory with exquisite control. Non-equilibrium processes are observable in real time. We can study the collision of "spin up" and "spin down" Fermi gases with resonant, quantum limited interactions. In equilibrium, the entire thermodynamics of the system are revealed in images of the trapped atomic gas, including the transition into the superfluid state. Scaled to the density of electrons, superfluidity would occur far above room temperature. We were recently able to follow the evolution of fermion pairing from three to two dimensions and to engineer spin-orbit coupling in these systems, connecting quite directly to models of layered superconductors and topological states of matter. Our measurements in and out of equilibrium provide benchmarks for current many-body theories and will help to understand other strongly interacting Fermi systems, such as high-temperature superconductors and neutron stars.