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Ultracold fermions: statics, dynamics, and quantum information.

Ultracold Fermi gases continue to be a remarkably versatile playground for
quantum many-body physics. At the moment, experimentalists have exquisite control not only of the temperature, density, and coupling (which is already impressive), but also of the number of flavors and the shape of the trapping potential (which can be varied essentially at will into all sorts of lattice shapes, including quasi-1D and 2D systems, and hard-wall boundary conditions). Additionally, a wide range of properties can be measured, from simple ones like the equation of state and momentum distribution, to more involved ones like the bulk viscosity and the Rényi entanglement entropy. In this talk, I will present an overview of some of those key experimental motivations for the theoretical investigation of strongly coupled non-relativistic matter in a variety of situations. I will outline our methods, show results for multiple systems, and describe the challenges ahead.

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