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Progress towards a Fermi Gas Microscope THOMAS GERSDORF, VINAY RAMASESH, TAKUMA INOUE, MELIH OKAN, DAVID REENS, JORDAN GOLDSTEIN, WASEEM BAKR, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — Attractively interacting degenerate Fermi gases near a Feshbach resonance have been used to realize the BEC-BCS crossover, while repulsive gases in optical lattices are expected to shed light on the physics of high-temperature superconductors. Local probes of these atomic systems should reveal microscopic correlations in such strongly interacting systems that cannot be directly extracted from bulk measurements. With the advent of quantum gas microscopy, the potential of such local probes has been demonstrated in bosonic gases. We are developing an experimental apparatus that combines quantum gas microscopy techniques with ultracold fermions in optical lattices to simulate strongly-correlated electronic systems. Our apparatus is designed to create degenerate gases of fermionic lithium and potassium as well as bosonic sodium. The gases will be loaded into a single layer of an optical lattice and imaged with a sub-micron resolution optical system capable of resolving individual sites. Our system opens the door to microscopic studies of phases that appear in the Fermi-Hubbard model including fermionic Mott insulators, antiferromagnets and d-wave superfluids, as well as topological phases that arise in the presence of synthetic gauge fields.

Thomas Gersdorf
Massachusetts Institute of Technology

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