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Towards a Quantum Gas Microscope for Ultracold Fermions

MATTHEW NICHOLS, LAWRENCE CHEUK, MELIH OKAN, VINAY RAMASESH[1], WASEEM BAKR[2], THOMAS LOMPE, MARTIN ZWIERLEIN, Massachusetts Institute of Technology — In the past decade ultracold atoms in optical lattices have been established as an ideal model system to study quantum many body physics in a clean and well-controlled environment. Recently, experiments at Harvard and MPQ Munich using bosonic ^{87}Rb atoms have made these systems even more powerful by demonstrating the ability to observe and address atoms in optical lattices with single-site resolution. The goal of our experiment is to achieve such single-site resolution for a quantum gas of fermionic atoms. Such local probing would reveal microscopic density or spin correlations which are difficult to extract from bulk measurements. This technique could for example be used to directly observe antiferromagnetic ordering in a fermionic Mott insulator. As the starting point for our experiments we cool fermionic potassium atoms with bosonic sodium as a sympathetic coolant. The atoms are then magnetically transported to an optical trap located ten microns below a solid immersion microscope for high-resolution imaging. In this poster we give a description of our experimental setup and report on our progress towards performing single-site resolved fluorescence imaging of ^{40}K atoms trapped in a deep optical lattice.

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