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Design and construction of a Site-resolved Optical Lattice for Ultracold Fermions DYLAN JERVIS, JOSEFINE METZKES, LINDSAY LEBLANC, ALMA BARDON, JASON MCKEEVER, MARCIUS EXTAVOUR, ALAN STUMMER, JOSEPH THYWISSEN, University of Toronto — Ultra-cold atoms in optical lattices allow for the study of lattice models, including the single-band and multi-band Hubbard models. The preparation and evolution of ultra-cold atoms in optical lattices is typically measured destructively through time-of-flight (TOF) imaging. At low temperatures, interesting many-body phases occur, including the Neel transition to anti-ferromagnetic ordering. However, when atoms are cooled below the interaction energy U the temperature becomes difficult to diagnose using TOF methods. We discuss a proposal to image a single plane of ultra-cold atoms in an optical lattice in-situ. Single-site imaging will permit an entropy, and thus temperature, measurement of the system. Spin-sensitive in-situ imaging will allow for local measurements of spin ordering and domain structure. The central feature of the proposed imaging system is a UHV cell in which ^{40}K fermions are trapped close (200μm) to a thin vacuum window, on the other side of which lies a microscope. We discuss the proposed design and recent progress.

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