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Quantum Gas Microscopy of Fermionic ^{40}K

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In the past decade, ultracold atoms have emerged as a pristine platform for quantum simulation of strongly correlated systems. One prototypical model is the Fermi-Hubbard model, a simple yet hard-to-solve Hamiltonian believed to capture aspects of high-T_c cuprates. In recent years, quantum gas microscopy (QGM) has made possible detection and control of single atoms within large ensembles, enabling novel studies of many-body systems. Although QGM of bosonic atoms had been pioneered in 2009, microscopy of fermionic atoms proved to be more challenging, requiring development of new imaging techniques. In this talk, I will describe how we perform QGM on fermionic ^{40}K, and some experiments that we have performed. Using our microscope, we have directly observed metals, band and Mott insulators. The site-resolving ability of QGM has also allowed measurement of spin and charge correlations. This has revealed the antiferromagnetic nature of spins and the bunching of doublons near half-filling, and anti-bunching of singlons at low fillings due to Pauli-blocking. With progress towards lower temperatures and novel studies on non-equilibrium dynamics, QGM experiments can potentially shed light on various mechanisms that are at work in strongly correlated systems.