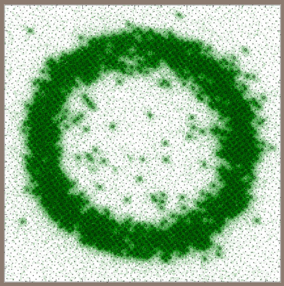
# Quantum gas microscopy of atomic Fermi-Hubbard systems

Ultracold fermions in optical lattices provide a clean physical realization of the celebrated Fermi-Hubbard model of condensed matter, a minimal model believed to contain the essential ingredients for high-temperature superconductivity. Recent advances in the field of quantum gas microscopy have opened up the possibility to probe and manipulate Fermi-Hubbard systems at the atomic level, enabling quantitative studies in a temperature regime that is challenging for state-of-the-art numerical simulations. In this talk I will report on experiments that probe equilibrium spin and density correlations in the Hubbard model in new regimes, including a repulsive spin-imbalanced system and a doped attractive system, which turn out to be related to each other through a mathematical mapping. I will also report on experiments where we measure the transport properties of doped repulsive systems and observe signatures of bad metallic behavior including a linear-in-temperature resistivity that violates the Mott-Ioffe-Regel limit.



## PHYSICS COLLOQUIUM

Thursday, April 19, 2018
4:10PM - LL.316
*Refreshments at 3:45PM*

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***Dr. Waseem Bakr*** *received his Ph.D. from Harvard University in 2011. During his doctoral thesis, he developed the technique of quantum gas microscopy for imaging atoms with single-atom and single-site resolution in optical lattices. He used this technique to study quantum phase transitions of bosons in optical lattices and in 1D quantum magnets. Between 2011 and 2013, Dr. Bakr was a post-doctoral researcher in Martin Zwierlein's group at MIT, where he experimentally explored strongly-correlated fermions, including experiments on lower dimensional gases, spin-orbit coupled systems and gases with topological excitations. Since Sept. 2013, Dr. Bakr has been an assistant professor in the Department of Physics at Princeton University. His group uses quantum gas microscopy techniques to study Fermi-Hubbard systems and quantum magnets realized with Rydberg atoms.*