

Wide-field microscopy of Sr atoms in optical lattices

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We are developing a Quantum Gas Microscope based on bosonic Sr-84 atoms to study the physics near the critical point in the 2D Bose-Hubbard model. Our goal is to make a large system with 100×100 lattice sites, as criticality is better observed in larger systems, and we can obtain more statistics for averaging correlations at finite distances. However, realizing such large systems requires working with relatively shallow optical lattices, which makes single-atom detection challenging.

In this talk, I will briefly introduce our Microscopy setup and discuss about the challenges we face in detecting single atoms trapped in a shallow optical lattice at 1064 nm. One key problem at 1064 nm is the value of the differential polarizability of the atomic transition used for fluorescence imaging (the intercombination line at 689 nm), which is crucial for in-trap laser cooling in the lattice. I will explain how we tune this parameter to go into the favourable regime for imaging. We have also studied a theoretical model for fluorescence imaging, which helped us optimize the trapping parameters. With our system, we have recently achieved site-resolved imaging of atoms. I will present these results and demonstrate the observation of the superfluid to Mott insulator transition in our 2D lattice gas.

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