Quantum distillation of bosons

DAVID WEISS, Penn State

The non-equilibrium dynamics of many-body quantum systems present a series of challenges for theory and opportunities for cold atom experiments. I will describe an experiment in which a bundle of initially trapped superfluid 1D Bose lattice gases is quenched to an untrapped, flat lattice potential. This simple experimental situation in the intermediate coupling regime (U/J between 4 and 9.6) leads to interesting dynamics. These include the progressive dissolution of a fraction of the doublons, as well as the quantum distillation and long term confinement of singlons out of and within the central, doublon-dominated region. We measure these processes by combining absorption imaging, photoassociation and 3-body loss to separately reconstruct the spatial distributions of the expectation values of singlons, doublons and triplons. The qualitative dynamics is reproduced by a Gutzwiller mean field model and the essence of the experiment can be understood by considering simple spatial pictures of site occupancies.

This work was supported by the NSF and the ARO.