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Near-equilibrium dynamics of an atomic gas near a quantum phase transition XIBO ZHANG, CHEN-LUNG HUNG, PETER SCHERPELZ, NATHAN GEMELKE, CHENG CHIN, University of Chicago — Atomic gases in optical lattices can establish thermodynamic equilibrium at two different length scales: locally over a few lattice sites and globally over the whole sample. While the time scales for atoms to reach local equilibrium depend on microscopic interaction and tunneling, the time scales to reach global equilibrium remain unknown. Here we study the near-equilibrium dynamics of a two-dimensional (2D) atomic gas near the bosonic superfluid to Mott insulator phase transition. Starting from a cesium-133 Bose-Einstein condensate in a 2D potential, we ramp up an optical lattice at different rates and observe the evolution of the atomic density profile using in situ microscopy. We analyze the density redistribution and extract relevant time scales for the sample to reach equilibrium. In addition, we probe the occupation number statistics by inducing three-body loss in the sample. We discuss how the detailed establishment of equilibrium affects studies of the superfluid and Mott insulator phases.

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