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Number statistics of a 2D quantum gas based on in situ imaging CHEN-LUNG HUNG, XIBO ZHANG, PETER SCHERPELZ, NATE GEMELKE, CHENG CHIN, University of Chicago — Two-dimensional (2D) ultracold atomic gases exhibit intriguing many-body phenomena, including critical behavior near a quantum phase transition. We present a system for in situ imaging of a 2D cesium-133 Bose-Einstein condensate loaded into a 2D optical lattice, revealing the spatial distribution of occupancy number and its fluctuations in a trapping potential. Furthermore, by inducing three-body recombination loss, number statistics can be probed directly in this system by comparing the density profile before and after loss. These tools provide unique information on these quantum gases, including the spatial variation of number squeezing in the lattice and non-equilibrium dynamics as the lattice depth is changed. This system also holds potential for probing many-body physics beyond the superfluid to Mott insulator transition, and at deep lattice depths, fundamental problems in few-body physics.

Peter Scherpelz
University of Chicago

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