Abstract Submitted
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The role of interactions, tunneling and harmonic confinement on the adiabatic loading of bosons in an optical lattice. ANA MARIA REY, ITAMP, GUIDO PUPILLO, Inst. Quantum Optics of the Austrian Academy of Science., Innsbruck, Austria., TREY PORTO, NIST, Gaithersburg, MD, USA — Cold atoms in optical lattices provide a system for realizing interacting many-body systems in essentially defect free lattices. Lattice-based systems are typically governed by three energy scales: interaction U, tunneling J and the temperature. In atomic systems, the energies U and J can be controlled by adjusting the lattice parameters, however, unlike condensed matter systems, it is experimentally difficult to measure very low temperatures. Absent good thermometers it is important to understand the thermodynamics of experimentally realistic systems. I will present entropy-temperature curves for interacting bosons in unit filled lattices for both homogeneous and harmonically trapped situations, and use them to understand how adiabatic changes in the lattice depth affect the temperature of the system. I will show that in the homogeneous case, unlike the non-interacting bosonic system which is always cooled upon adiabatic loading for low enough initial temperature, the change in the excitation spectrum induced by interactions can lead to heating. On the other hand the presence of the parabolic confinement can significantly reduce the final available temperature, due to the non-vanishing superfluid component at the edge of the cloud in trapped systems.

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