Abstract Submitted
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Utilizing nonequilibrium effects to probe the Mott-insulator-superfluid transition of a trapped gas of interacting bosons[1] LEV VIDMAR, LMU Munich, S. LANGER, University of Pittsburgh, I. MCCULLOCH, University of Queensland, St Lucia, U. SCHOLLWOECK, LMU Munich, U. SCHNEIDER, LMU Munich and MPQ Garching, F. HEIDRICH-MEISNER, FAU Erlangen-Nuremberg and LMU Munich — An increased effort has been lately devoted to explore and establish the possible links between equilibrium and nonequilibrium properties of interacting quantum many-body systems. Recent experiments on optical lattices have shown the possibility of measuring the expansion velocity of an initially trapped system, which after the sudden release of the trap expands in an empty lattice [1]. Recent theoretical studies of interacting fermions indicated that the measurement of expansion velocity may provide information about the initial state [2]. In our work, we show that measuring the expansion velocity of an initially trapped gas of interacting bosons allows one to distinguish between a superfluid and a Mott insulating state in the initial ground state in 1D. We perform time-dependent DMRG calculations of the Bose-Hubbard model in a harmonic trap and a box trap. We derive a state diagram of a trapped system as a function of Coulomb repulsion and density from the expansion velocity. The resulting diagram is consistent with the state diagram obtained by measuring equilibrium properties such as local density fluctuations and on-site compressibility [3]. [1] Schneider et al. Nature Physics 8, 213 (2012) [2] Langer et al., PRA 85, 043618 (2012) [3] Rigol et al, PRA 79, 053605 (2009)

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