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Long range bosonic correlations in 2D optical lattice traps K.W. MAHMUD, University of California, Davis, E.N. DUCHON, Ohio State University, Y. KATO, Los Alamos National Laboratory, N. KAWASHIMA, University of Tokyo, R.T. SCALETTAR, University of California, Davis, N. TRIVEDI, Ohio State University — We use quantum Monte Carlo (QMC) simulations to study the combined effects of harmonic confinement and temperature for bosons in a two dimensional optical lattice. We present the scale invariant, finite temperature, state diagram for the Bose- Hubbard model in terms of experimental parameters - the particle number, confining potential and interaction strength. We examine the correlation decay of the superfluid trapped in annular rings, and find that the width of the superfluid ring determines a distance after which the correlation decays faster than in an equivalent 2D superfluid. At zero temperature, the correlation decay is intermediate between 1D and 2D decay, while at finite temperature, the decay is similar to a 1D decay at a much lower temperature. These provide the strongest evidence for the breakdown of the local density approximation (LDA) in trapped superfluid bosons.

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