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Quantum Phase Transition in Hard-Core Bosons Due to Background Potentials ANAND PRIYADARSHEE, JI-WOO LEE, SHAILESH CHANDRASEKHARAN, HAROLD BARANGER, Duke University — We study the zero temperature phase diagram of hard-core bosons hopping on a two dimensional lattice under the influence of three types of background potentials: (1) staggered, (2) uniform, and (3) random (on-site disorder). Using the directed-loop quantum Monte Carlo algorithm on large square lattices, we examine the susceptibility, superfluid density, compressibility, and particle-particle correlation length. For all three types of potentials, the system undergoes a quantum phase transition from a superfluid phase at small potential to a normal phase when the applied potential is large. For a staggered or uniform potential, the transition is to an insulating phase; as expected, the staggered case shows XY universality, while the uniform case belongs to the mean field universality class with dynamic exponent z=2. In contrast, the disorder driven transition is clearly different from either of these. We find a transtion to a phase with non-zero compressibility with critical exponents $\nu \sim 1$, $\beta \sim 0.6$ and $z \sim 1.4$

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