Finite temperature crossover from Mott insulator to Bose glass state in trapped boson system in the presence of diagonal disorder

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We study a finite temperature phase diagram of the ultracold atomic gas, trapped in a periodic potential with diagonal (on-site) disorder. Such system is described by the Bose-Hubbard (BH) model. Our system is a 300 sites chain lattice, with open boundary conditions, and with 90 bosons in it. In considered system there are not only two basic phases of BH model - Mott insulator (MI) and superfluid (SF) phases - but also a third phase appears, Bose glass (BG). For simulations performed with quantum Monte Carlo method, we use the worm algorithm from ALPS libraries. The analysis of the simulation results consists in checking, how the root mean square of the atomic cloud radius changes, while squeezing it with an external, quadratic potential. From the reaction we get a signal of the MI-BG crossover. By doing few diagrams of temperature vs. disorder, for different values of hopping parameter, we get a simplified, three dimensional phase structure of this system.

9.7 cm

13.4 cm

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