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On-site number statistics of ultracold lattice bosons EVGENY KOZIK, BARBARA CAPOGROSSO-SANSONE, NIKOLAY PROKOF'EV, BORIS SVISTUNOV, University of Massachusetts Amherst — We study on-site occupation number fluctuations in a system of interacting bosons in an optical lattice. The ground-state distribution is obtained analytically in the limiting cases of strong and weak interaction, and by means of exact Monte Carlo simulations in the strongly correlated regime. As the interaction is increased, the distribution evolves from Poissonian in the non-interacting gas to a sharply peaked distribution in the Mott-insulator (MI) regime. In the special case of large occupation numbers, we demonstrate analytically and check numerically that there exists a wide interval of interaction strength, in which the on-site number fluctuations remain Gaussian and are gradually squeezed until they are of order unity near the superfluid (SF)-MI transition. Recently, the on-site number statistics were studied experimentally in a wide range of lattice potential depths [Phys. Rev. Lett. **96**, 090401 (2006)]. In our simulations, we are able to directly reproduce experimental conditions using temperature as the only free parameter. Pronounced temperature dependence suggests that measurements of on-site atom number fluctuations can be employed as a reliable method of thermometry in both SF and MI regimes.

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