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Phase diagram of the hardcore Bose-Hubbard model with a superlattice ITAY HEN, Georgetown University, M. ISKIN, Koç University, MARCOS RIGOL, Georgetown University — The quantum phase transition from a Bose-Einstein condensate to a state composed of localized atoms is usually described by the Bose-Hubbard model, where the transition is thought to be from a superfluid phase to a Mott-insulating one. It has recently been argued that this transition can also be examined by considering a simpler variant of the model, namely the limit of hardcore bosons in the presence of a period-two superlattice. In this talk, I will present the results of a new study that explores the phase diagram of this model. While the boundary of the Mott phase is obtained by quantum Monte Carlo techniques, the boundaries between the empty and completely filled lattices and the superfluid phase have simple analytical expressions. The study also examines the extent to which approximation schemes, such as mean-field theory (with and without spin-wave corrections) and fourth-order strong-coupling expansion, give an accurate description of the phase diagram. I will show that the phase diagram produced by the strong-coupling expansion is the most accurate.

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