

Bose–Einstein quantum phase transition in an optical lattice model

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Abstract

Bose–Einstein condensation (BEC) in cold gases can be turned on and off by an external potential, such as that presented by an optical lattice. We present a model of this phenomenon which we are able to analyze rigorously. The system is a hard core lattice gas at half-filling and the optical lattice is modeled by a periodic potential of strength λ . For small λ and temperature, BEC is proved to occur, while at large λ or temperature there is no BEC, and the low-temperature states are in a Mott insulator phase with a characteristic gap.