Bose Condensation of a Bose Gas in a Lattice

D. P. Sankovich

V. A. Steklov Mathematical Institute, RAS, 8 Gubkin Str., 119991 Moscow, Russia

A canonical system of interacting bosons is considered to study phase transitions of cold atoms in a 3D lattice. A major interest of bosonic systems is the possibility of displaying a Bose condensation (BC). Lattice Bose gas models are relevant not only as an alternative way to understand continuous boson systems of interacting particles including liquid helium. These models do for a real physical systems of cold bosons in traps of 3D optical lattice potentials. Thus, for instance the so-called Bose–Hubbard model explains the experimentally observed Mott insulator-superfluid (BC) phase transition. Here the Bose–Hubbard model is studied within the Bogolyubov functional integral approach. It is shown that such system exhibits BC for any temperature. The corresponding conditions for a filling fraction, a hopping amplitude and an on-site repulsion are found.