Supersolid and solitonic phases in the one-dimensional extended Bose-Hubbard model

Ramesh V. Pai

Department of Physics

Goa University

Taleigao Plaeau

Goa - 403 206

The supersolid phase, first reported way back in 1956 in He-4, is characterized by the simultaneous presence of two types of quasi-long-range order: the charge density wave and the superfluid. Experimental and theoretical investigations on the possibility of thermodynamically stable supersolidity in the solid Helium have seen an enormous resurgence in the recent years. In parallel, the advances in the manipulation of cold bosonic atoms in optical lattices have opened up a new route to possible observation of the supersolid phase, especially after the observation of the Bose-Einstein condensation of ^{52}Cr atoms, which have large magnetic-dipole moments. The strongly dipolar ultracold bosonic atoms in the optical lattices can be described by the extended Bose-Hubbard model. In this context, we present results of the finite size density matrix renormalization group calculations for the soft-core extended bosonic Hubbard model in one dimension exhibiting the presence of supersolid and solitonic phases in addition to superfluid, Mott insulator and charge density wave phases.