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Excitations and quantum phase transitions of Supersolid and Haldane Insulator phases in the extended one-dimensional bosonic Hubbard model[1] GEORGE BATROUNI, Institut Non-Linéaire de Nice, University of Nice, VALERY ROUSSEAU, Physics Department, Louisiana State University, RICHARD SCALETTAR, Physics Department, UC Davis, BENOÎT GRÉMAUD, Laboratoire Kastler Brossel, CNRS, Paris VI — The Haldane Insulator is a gapped phase characterized by an exotic non-local order parameter. It appears in reduced dimensionality models such as spin chains and the one-dimensional bosonic Hubbard model (BHM) with contact and near neighbor repulsive interactions. The parameter regimes at which it might exist, and how it competes with alternate types of order, such as supersolidity, are studied using the Stochastic Green Function quantum Monte Carlo and the Density Matrix Renormalization Group. We show that, depending on the ratio of the near neighbor to contact interactions, this model exhibits charge density waves (CDW), superfluid (SF), supersolid (SS) and the recently identified Haldane insulating (HI) phases. We show that the HI exists only at the tip of the unit filling CDW lobe and that there is a stable SS phase over a very wide range of parameters. We also present results for the excitation spectra in the various quantum phases.

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