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Cold Atoms on Frustrating Lattices DAGIM TILAHUN, ALLAN MACDONALD, The University of Texas at Austin — Ultracold atoms in optical lattices undergo a quantum phase transition from a superfluid to a Mott insulator as the lattice potential depth is increased. We present a theory of the ground state and the elementary excitations of cold atoms in which the potential Σ_i which induces coherence between different number states on a given site is elevated from a variational parameter to a quantum degree of freedom. In this approach mean-field theory is equivalent to minimizing the energy with respect to the Σ_i. The theory is applied to the Boson Hubbard model of optical lattice systems, to frustrated lattice models for rotating atoms, and to inhomogenous systems with a harmonic trapping potential superimposed on the lattice potential.

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