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Polar molecules with strong three-body repulsions on two-dimensional hexagonal lattice LARS BONNES, HANSPETER BÜCHLER, STEFAN WESSEL, Institute for Theoretical Physics III, University of Stuttgart — Motivated by a recent proposal on using polar molecules in optical lattices driven by microwave fields to induce strong three-body interactions (H. P. Büchler et al., Nature Physics 3, 726 (2007)), we analyze the quantum phase diagram of the hard-core boson Hubbard model with competing two- and three-body interactions. In particular, we consider the case of the honeycomb lattice. The rich phase diagram, which we access using quantum Monte Carlo simulations, shows a variety of complex valence bond crystal phases, emerging out of classical ground-states of extensive degeneracies. We obtain effective description of these phases in terms of local resonances and quantum dimer models. Cascading transitions result from the competition of the two types of interaction terms. Furthermore, we revisit the bose Hubbard model on the triangular lattice, and consider the nature and stability of its supersolid phases in the presence of three-body repulsions.

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