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Dipolar lattice bosons in the presence of long-range hopping

CHAO ZHANG, Univ of Oklahoma, ARGHAVAN SAFAVI-NAINI, JILA, National Institute of Standards and Technology and Department of Physics, University of Colorado, 440 UCB, Boulder, CO 80309, USA, BARBARA CAPOGROSSO-SANSONE, Department of Physics, Clark University, Worcester, MA 01610, USA — We report on numerical results based on quantum Monte Carlo simulations of a system of two-dimensional hard-core lattice bosons in the presence of long-range hopping and long-range two-body interactions resulting from dipole-dipole interactions. This is equivalent to the XXZ model in the presence of dipolar interactions which can be realized by a lattice gas of polar molecules, creating a flexible platform for the study of quantum magnetism. The system features three phases: a superfluid, a supersolid, and a checkerboard solid. Next we mimic the current experimental conditions, that is a lattice of polar molecules away from unit filling, by adding static disorder. Under these conditions we study the localization of particles and the stabilization of a disorder-induced insulating phase.

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