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Staircase of crystal phases of hard-core bosons on the kagome lattice DANIEL HUERGA, Institut Theoretische Physik III, Universitat Stuttgart, Germany, SYLVAIN CAPPONI, Laboratoire de Physique Theorique, Universite de Toulouse, France, JORGE DUKELSKY, Instituto de Estructura de la Materia, CSIC, Spain, GERARDO ORTIZ, Physics Department, Indiana University, US
— We study the quantum phase diagram of a system of hard-core bosons on the kagome lattice with nearest-neighbor repulsive interactions, for arbitrary densities, by means of the hierarchical mean-field theory and exact diagonalization techniques. This system is isomorphic to the spin S = 1/2 XXZ model in presence of an external magnetic field, a paradigmatic example of frustrated quantum magnetism. In the nonfrustrated regime, we find two crystal phases at densities 1/3 and 2/3 that melt into a superfluid phase when increasing the hopping amplitude, in semiquantitative agreement with quantum Monte Carlo computations. In the frustrated regime and away from half-filling, we find a series of plateaux with densities commensurate with powers of 1/3. The broader density plateaux (at densities 1/3 and 2/3) are remnants of the classical degeneracy in the Ising limit. For densities near half-filling, this staircase of crystal phases melts into a superfluid, which displays finite chiral currents when computed with clusters having an odd number of sites. Both the staircase of crystal phases and the superfluid phase prevail in the noninteracting limit, suggesting that the lowest dispersionless single-particle band may be at the root of this phenomenon.

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