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A doped interacting quantum dimer model on the square lattice
STEFANOS PAPANIKOLAOU, ERIK LUIJTEN, EDUARDO FRADKIN, University of Illinois at Urbana-Champaign — We introduce a generalized quantum dimer model [1] for interacting dimers on the square lattice [2] which can be mapped to generic 2D classical partition functions. More specifically, we show that the amplitudes of the exact ground state wavefunction are given by the Gibbs weights of a 2D classical doped interacting dimer model. We use this mapping to determine the phase diagram in the interaction - hole density plane. Analytically, we exploit a direct microscopic mapping of the classical dimer model on the square lattice to a special 8-vertex model and generalized Coulomb gases. Numerically, we use a novel rejection-free geometrical cluster algorithm [3] for classical interacting dimers on the square lattice, in the canonical ensemble. We also use simulations to study the system in the grand canonical ensemble. We discuss the structure of the phase diagram and its critical behavior. 1. D.S. Rokhsar and S.A. Kivelson, PRL 61, 2376 (1988), 2. F. Alet et al. PRL 94, 235702 (2005), 3. J. Liu and E. Luijten, PRL 92, 035504 (2004).

Stefanos Papanikolaou
University of Illinois at Urbana-Champaign

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