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Dimer liquid state in the quantum dimer-pentamer model on the square lattice OWEN MYERS, University of Vermont, C.M. HERDMAN, University of Waterloo — We study the ground state of the quantum dimer-pentamer model (QDPM) on the square lattice. This model is a generalization of the square lattice quantum dimer model (QDM) as its configuration space comprises fully-packed hard-core dimer coverings as well as configurations containing pentamers, where four dimers touch a vertex. Thus in the QDPM, the fully-packed, hard-core constraint of the QDM is relaxed such that the local dimer number at each vertex is fixed modulo 3; correspondingly, the local $U(1)$ gauge symmetry of the QDM Hilbert space is reduced to a local Z_3 gauge symmetry in the QDPM. We construct a local Hamiltonian for which the Rokhsar-Kivelson (RK) state (the equal superposition of all configurations in a topological sector) is the exact ground state and has a 9-fold topological degeneracy on the torus. Using Monte Carlo calculations, we find no spontaneous symmetry breaking in the RK wavefunction and that its dimer-dimer correlation function decays exponentially. Additionally, we discuss the possibility of Z_3 topological order in the ground state of the QDPM.

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