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Frustration, lattice gauge theories and order-by-disorder in quantum plaquette models with linear and nonlinear constraints

We present results from plaquette models with ground states coming from both linear and nonlinear constraint rules. For the linear case, we study the triangular plaquette spin model, which we also study in the presence of an external longitudinal magnetic field. For the latter case, we study spin models whose ground state constraints come from nonlinear elementary cellular automaton rules. We present evidence that indicates that these quantum models, when in the presence of a transverse field term, show first-order quantum phase transitions. We discuss implications of their phase diagram regarding effects of frustration, magnetization plateaus, order-by-disorder, lattice gauge theories, Rydberg models and quantum trimers.

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