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Deconfined quantum-criticality in a 2D $S = 1/2$ Heisenberg model[1] ANDERS SANDVIK, Boston University — The two-dimensional $S = 1/2$ Heisenberg model including a four-spin interaction is studied using a ground state projector quantum Monte Carlo (QMC) method in the valence bond basis. The model is sign-problematic in standard QMC methods formulated in the S^z basis, but not in the valence bond basis. The ground state is studied on lattices with up to 40×40 spins. The four-spin interaction is shown to suppress the antiferromagnetic order, leading to a phase transition into a valence-bond-solid (VBS) state. The finite-size scaling of the singlet-triplet gap (which can be calculated with the valence bond projector using an improved estimator) scales as $1/L$ at the transition point, indicating a quantum phase transition with dynamic exponent $z = 1$. This, and a large spin-spin correlation exponent, $\eta \approx 0.4$, suggests that the transition is a *deconfined quantum-critical point*. This would then be the first example of a model Hamiltonian for which this exotic Néel–VBS quantum-criticality has been observed.

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