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Entanglement scaling of the 2D RVB wavefunction HYEJIN JU, University of California, Santa Barbara, ANN KALLIN, University of Waterloo, PAUL FENDLEY, University of Virginia, Microsoft Station Q, MATTHEW HASTINGS, Duke University, Microsoft Station Q, ROGER MELKO, University of Waterloo — The resonating valence bond (RVB) state on a two-dimensional lattice is a superposition of all permutations of singlet spin pairs. This wavefunction was first proposed by Anderson as a simple spin liquid ground state, showing no long range order at T=0. Using a loop-algorithm Monte Carlo method that samples all nearest-neighbor singlet pairs, we examine the entanglement entropy of the nearest neighbor SU(2) RVB wavefunction on the square lattice. In addition to the area law, we show that the entanglement entropy splits into two branches, due to the different topological sectors of the RVB wavefunction. These branches individually scale with a logarithmic dependence on the size of the entangled region, the functional form of which appears to be similar to the conformal distance observed in scaling at conformal critical points in 1D. We comment on the implication for the search for topological order, and on generalizations of this wavefunction, including models involving SU(N) spins.

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