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Topological Properties of Two-Dimensional Resonating-Valence-Bond States[1] YING TANG, ANDERS SANDVIK, Boston University — We study the short-range resonating-valence-bond state on the two-dimensional square lattice, using Monte Carlo simulations with both loop-cluster and two-bond updates, combined with spin configurations sampled according to the singlet coverings. We calculate the four-spin (dimer-dimer) correlations and find that they decay as $r^{-\alpha}$ with $\alpha \approx 1.2$, instead of $\alpha = 2$ as found in classical dimer model (which represents the ground state of the quantum dimer model at the Rokhsar-Kivelson critical point). Moreover, in different topological (winding number) sectors, these four-spin correlations, though having the same exponent α, are affected by the presence of domain-wall like extended topological defects. By virtue of these defects, the different topological sectors should not be degenerate. We show that the bond energies grow with increasing winding number (which also corresponds to the number of domain walls).

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