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Properties of the random-singlet phase[1] YU-RONG SHU, DAO-XIN YAO, Sun Yat-Sen University, CHIH-WEI KE, YU-CHENG LIN, National Chengchi University, ANDERS SANDVIK, Boston University — We use a strong-disorder renormalization group (SDRG) method and ground-state quantum Monte Carlo (QMC) simulations to study $S = 1/2$ spin chains with random couplings, calculating disorder-averaged spin and dimer correlations. The QMC simulations demonstrate logarithmic corrections to the power-law decaying correlations obtained with the SDRG scheme. The same asymptotic forms apply both for systems with standard Heisenberg exchange and for certain multi-spin couplings leading to spontaneous dimerization in the clean system. We show that the logarithmic corrections arise in the valence-bond (singlet pair) basis from a contribution that can not be generated by the SDRG scheme. In the model with multi-spin couplings, where the clean system dimerizes spontaneously, random singlets form between spinons localized at domain walls in the presence of disorder. This amorphous valence-bond solid is asymptotically a random-singlet state and only differs from the random-exchange Heisenberg chain in its short-distance properties.(See also arXiv:1603.04362).

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