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Fluctuation Length Scales in Random Singlet Phases HUAN TRAN, NICK BONESTEEL, Department of Physics and NHMFL, Florida State University — For any disorder strength, the ground state of the random-bond spin-1/2 AFM Heisenberg chain flows to an infinite-randomness fixed point and a random singlet (RS) state forms on long length scales.[1] This state can be characterized by its valence-bond entanglement entropy,[2] defined to be $\overline{\langle n_L \rangle}$, the average number of valence bonds leaving a block of L spins, as well the fluctuations of this number, $\sigma_L^2 = \overline{\langle n_L^2 \rangle - \langle n_L \rangle^2}$, (angle brackets denote amplitude weighted averages over valence-bond states in the ground state, and overbar denotes disorder average). For large L, $\overline{\langle n_L \rangle}$ scales logarithmically, indicating a power-law distribution of valence-bond lengths, while σ_L^2 *saturates* at a crossover length scale ξ, beyond which the valence bonds "lock" into a particular RS configuration.[3] Using valence-bond Monte Carlo, we have studied the dependence of ξ on disorder strength in the limit of weak disorder for both the Heisenberg chain and the critical random transverse-field Ising model. We compare our results with previous calculations of related crossover length scales in these models.[4]

[1]D. S. Fisher, PRB **50**, 3799 (1994).
[2]F. Alet, *et al.*, PRL **99**, 117204 (2007).
[3]H. Tran and N. E. Bonesteel, arXiv:0909.0038.
[4]N. Laflorencie *et al.*, PRB **70**, 054430 (2004).

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