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Entanglement spectrum and entangled modes of highly excited states in random XX spin chains MOHAMMAD POURANVARI, KUN YANG, National High Magnetic Field Laboratory and Department of Physics, Florida State University, Tallahassee, Florida 32306, USA — We examine the newly developed real space renormalization group method of finding excited eigenstate (RSRG-X) of the XX spin-1/2 chain, from entanglement perspectives. Eigenmodes of the entanglement Hamiltonian, especially the maximally entangled mode (that contributes the most to the entanglement entropy) and corresponding entanglement energies are studied and compared with predictions of RSRG-X. Our numerical results demonstrate the accuracy of the RSRG-X method in the strong disorder limit, and quantify its error when applied to weak disorder regime. Overall, our results validate the RSRG-X method qualitatively, but as in the case of real space renormalization group method for the ground state (RSRG) there are quantitative errors for weaker randomness, and also such error grows with increasing temperature/excitation energy density.

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