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Entanglement entropy of the Q ≥ 4 quantum Potts chain

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Abstract content
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The entanglement entropy, S, is an indicator of quantum correlations in the ground state of a many body quantum system. At a second-order quantum phase-transition point in one dimension S generally has a logarithmic singularity.
Here we investigate the Q-state quantum Potts chain for Q ≥ 4 and calculate S across the transition point. The density matrix renormalization group (DMRG) method was applied and a logarithmic divergence was found for the Q=4 at the second-order phase transition and finite jump of S for Q=6 & 8 at the first-order quantum phase transition. The jump of the entanglement entropy S is analytically calculated in leading order of Q and was found in good agreement with the DMRG results. Furthermore, the DMRG data are considered from several aspects in order to demonstrate that the DMRG method can be an appropriate technique for calculating the entanglement entropy at or around the phase transition.

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