Entanglement Entropy in Valence-Bond-Solid States on Symmetric Graphs

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We study entanglement entropy of Valence-Bond-Solid (VBS) state on square lattice and hexagonal lattice [1]. The VBS state is the ground state of the Affleck-Kennedy-Lieb-Tasaki model. We consider a reduced density matrix of a subsystem which is a mirror image of the other one. Due to the re ection symmetry, we can easily obtain the matrix elements of the reduced density matrix by Monte Carlo integration. In this study, we calculate the entanglement entropy of the reduced density matrix. The obtained results indicate that there is some deviation from the naive expectation that the entanglement entropy per valence bond on the boundary between the subsystems is log 2. This deviation is interpreted in terms of the hidden spin chain along the boundary between the subsystems. In some cases where graphs are on ladders, the numerical results are analytically or algebraically confirmed.

References

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