Density matrix renormalization group study of the Kitaev honeycomb lattice model ZHENYUE ZHU, University of California, Irvine, STEVEN WHITE — The Kitaev model on the honeycomb lattice can be solved exactly through mapping into free majorana fermions with a Z_2 gauge field. As a benchmark for DMRG on this two dimensional system, we have simulated this model with a cylindrical geometry with varying widths. The ground state energy and degeneracy match well with theoretical predictions. The different degenerate ground states exhibit the same short range spin-spin correlation patterns. The von Newmann entanglement entropy and its spectrum are evaluated. We show that the entropy of the Kitaev model satisfies the area law, with the entropy being more specifically proportional to the number of bonds cut at the boundary between the two different regions. The degeneracy of entanglement spectrum can also be determined by the number of dangling majorana fermions at the cut. The above results hold for both the gapped and gapless phase. The non-Abelian phase obtained by applying a magnetic field, which is not exactly solvable, will also be discussed.

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