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Entanglement entropy and other observables of topological phases with finite correlation length STEFANOS PAPANIKOLAOU, University of Illinois, Urbana-Champaign, KUMAR S. RAMAN, University of California, Riverside, EDUARDO FRADKIN, University of Illinois, Urbana-Champaign — We elucidate the topological features of the entanglement entropy of a region in two dimensional quantum systems with a finite correlation length. Firstly, we suggest that simpler reduced quantities, related to the von Neumann entropy, could be defined to compute the topological entropy. We use our methods to compute the entanglement entropy for the ground state wave function of a quantum eight-vertex model in its topological phase, and show that a finite correlation length adds corrections of the same order as the topological entropy which come from sharp features of the boundary of the region under study. We also calculate the topological entropy for the ground state of the quantum dimer model on a triangular lattice by using a mapping to a loop model. The topological entropy of the state is determined by loop configurations with a non-trivial winding number around the region under study. Finally, we consider extensions of the Kitaev wave function, which incorporate the effects of electric and magnetic charge fluctuations, and use it to investigate the stability of the topological phase by calculating the topological entropy. arxiV: 0709.0729

Stefanos Papanikolaou
University of Illinois, Urbana-Champaign

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