Title: Bicolor loop models and their long range entanglement

Author: Zhao Zhang

Abstract: Quantum loop models are well studied objects in the context of lattice gauge theories and topological quantum computing. They usually carry long range entanglement that is captured by the topological entanglement entropy. I consider generalization of the toric code model to bicolor loop models and show that the long range entanglement can be reflected in three different ways: a topologically invariant constant, a sub-leading logarithmic correction to the area law, or a modified bond dimension for the area-law term. The Hamiltonians are not exactly solvable for the whole spectra, but admit a tower of area-law exact excited states corresponding to the frustration free superposition of loop configurations with arbitrary pairs of localized vertex defects. The continuity of color along loops imposes kinetic constraints on the model and results in Hilbert space fragmentation, unless plaquette operators involving two neighboring faces are introduced to the Hamiltonian.