

Topological phases in quantum lattice models

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Topological field theories can be realized as topological phases in certain integrable models and two-dimensional strongly-correlated condensed matter systems. I will review our solution of the Kitaev honeycomb spin lattice model based on its mapping to spinful paired fermions. The solution allowed us, among other things, to formulate interesting generalizations of this system that culminated in the square octagon model which enjoys a rich phase diagram exhibiting also non-Abelian topological phases relevant to the Ising and $SU(2)_2$ anyon models. Quasiparticle excitations of these phases have recently attracted considerable attention both for fundamental reasons as a system with non-Abelian fractional statistics and for potential applications in topological quantum computation.