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Tensor Network Representations of Critical Quantum Systems via the Levin-Wen Construction[1] MICHAEL FLYNN, RAJIV SINGH, MUKUND RANGAMANI, ANDREW ESSIN, Univ of California - Davis — We briefly introduce the Levin-Wen construction, a method for creating exactly solvable quantum mechanical lattice models which correspond to fixed-point continuum gauge theories and doubled Chern-Simons theories in $(2+1)D$. The Levin-Wen construction naturally leads to the introduction of tensor networks as a method to efficiently calculate partition functions and other data for finite-size systems. By specializing to the case of the Z_2 lattice gauge theory, we will show how to construct a tensor network representation of the theory's ground state, while gaining insight into the behavior of the time-evolution of the system. As expected, four topological sectors are observed whose ground states are equal-weight superpositions of the vortex-free states in each topological sector. We will then discuss generalizations of these techniques to other lattice models, and argue that similar schemes for constructing tensor networks should generate ground states for other Levin-Wen Hamiltonians. If time allows, a discussion of the application of tensor networks to the $U(1) \times U(1)$ Chern-Simons (double semion) theory will be included.

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