

Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Path to building quantum spin liquids and topological qubits within existing quantum hardware"

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Abstract: We address a central problem in the creation and manipulation of quantum states: how to build topological quantum spin liquids with physically accessible interactions. Theorists have been studying models of quantum spin liquids that rely on "multi-spin" interactions since the 1970s, and, more recently, have realized that these models can be used for quantum computing. However, nature does not provide such interactions in real materials. We construct a lattice gauge model where the required, fully quantum, multi-spin interactions can in fact be emulated exactly in any system with only two-body Ising interactions plus a uniform transverse field. The latter systems do exist, and we provide an explicit embedding of our model into one such system, the commercially available D-Wave machine. Therefore, our solution is an alternative path to building a workable topological quantum computer within existing hardware. Our bottom-up construction is generalizable to other gauge-like theories, including those with fractonic topological order such as the X-cube model. Taken as a whole, our approach is a blueprint to emulate topologically ordered quantum spin liquids in programmable quantum machines.

2:00PM
Friday, October 4, 2019
Duboc Room (4-331)