Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

"Exact bosonization in higher dimensions and the duality between supercohomology fermionic SPT and higher-group bosonic SPT phases"

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Abstract: The first part of this talk will introduce generalized Jordan–Wigner transformation on arbitrary triangulation of any simply-connected manifold in 2d, 3d, and general dimensions. This map gives a duality between all fermionic systems and a new class of lattice gauge theories. This map preserves the locality and has an explicit dependence on the second Stiefel–Whitney class and a choice of spin structure on the manifold. In the Euclidean picture, this mapping is equivalent to introducing topological terms (Chern-Simon term in 2d or Steenrod square term in general) to the Euclidean action. We can increase the code distance of this mapping, such that this mapping can correct all 1-qubit and 2-qubits errors and is useful for the simulation of fermions on the quantum computer. The second part of my talk is about SPT phases. By the boson-fermion duality, we can show the equivalent between any supercohomology fermionic SPT and some higher-group bosonic SPT phases. Particularly in (3+1)D, we have constructed a unitary quantum circuit for any supercohomology fermionic SPT state with gapped boundary construction. This fermionic SPT state is derived by gauging higher-form symmetry in the higher-group bosonic SPT and applying the boson-fermion duality.

12:00pm noon
Tuesday, November 26, 2019
Duboc Room (4-331)

Host: Maxim Metlitski