Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

" Numerical Study of a Bosonic Topological Insulator in Three Dimensions "

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Abstract: We construct a model which realizes a (3+1)-dimensional symmetry-protected topological phase of bosons with U(1) charge conservation and time reversal symmetry, envisioned by A. Vishwanath and T. Senthil [PRX 4 011016]. Our model works by introducing an additional spin degree of freedom, and binding its hedgehogs to a species of charged bosons. We study the model using Monte Carlo and determine its bulk phase diagram; the phase where the bound states of hedgehogs and charges condense is the topological phase, and we demonstrate this by observing a Witten effect. We also study the surface phase diagram on a (2+1)-dimensional boundary between the topological and trivial insulators. We find a number of exotic phases on the surface, including exotic superfluids, a phase with a Hall conductivity quantized to half the value possible in 2D, and a phase with intrinsic topological order. We also find a new bulk phase with intrinsic topological order.

12:00noon
Thursday, November 6, 2014
Duboc Room (4-331)

Host: Senthil Todadri