Massachusetts Institute of Technology
Department of Physics

Condensed Matter Theory Seminar

" Bilayer Graphene as a Platform for Bosonic Symmetry Protected Topological States"

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Abstract: Bosonic symmetry protected topological (BSPT) states, i.e. bosonic analogue of topological insulators, have attracted enormous theoretical interests and efforts in the last few years. Although the BSPT states have been successfully classified with various approaches, there has been no successful experimental realization of BSPT states yet in two and higher dimensions. In this paper, we propose that the two dimensional BSPT state with U(1) × U(1) symmetry can be realized in a bilayer graphene under a tilted magnetic field, where the two U(1) symmetries stand for the total spin Sz and total charge conservation respectively. The Coulomb interaction plays a central role in this proposal: 1. it gaps out all the fermions at the boundary of the system, hence the remaining symmetry protected gapless boundary states only have bosonic charge and spin degrees of freedom; 2. based on the conclusion above, we propose that the bulk quantum phase transition between the BSPT and trivial phase, which can be driven by a competition between the out-of-plane magnetic field and electric field, under strong interaction can become a "bosonic phase transition", i.e. only bosonic modes close their gap at the transition. This transition is fundamentally different from all the well-known topological-trivial transition in the free fermion topological insulators. The latter statement is supported by recent determinant quantum Monte carlo simulation on a similar sign-problem-free model on a bilayer honeycomb lattice.

12:00pm
Tuesday, December 6, 2016
Duboc Room (4-331)

Host: Michael Pretko