Weekly Seminar

Interaction-driven topological phase transition in correlated symmetry protected topological states

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Venue: w563, Physics building, Peking University

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Abstract

It is expected that the interplay between non-trivial band topology and strong electron correlation will lead to rich physics, thus a controlled study of the competition between topology and correlation is of great interest. Here, employing large-scale quantum Monte Carlo simulations, I will introduce a concrete example of the Kane-Mele-Hubbard model on an AA stacking bilayer honeycomb lattice with inter-layer antiferromagnetic interaction. Our simulations identified three different phases: a quantum spin-Hall insulator (QSH), a xy-plane antiferromagnetic Mott insulator and an inter-layer dimer-singlet insulator. Most importantly, an exotic topological phase transition between the QSH and the dimer-singlet insulators, purely driven by the inter-layer antiferromagnetic interaction is found. At the transition, the spin and charge gap of the system close while the single-particle excitations remain gapped, which renders this transition no mean field analogue and a transition between bosonic SPT states. This transition is described by a (2+1)d O(4) nonlinear sigma model with exact SO(4) symmetry, and a topological term at exactly Theta=Pi. I will also discuss a new, general technique -- strange correlator -- that we have developed to directly minitor the edge states of topological insulators in the presence of interaction. Relevance of these works towards more general interacting symmetry protected topological states will be discussed.

References:

Phys. Rev. B 92, 165123 (2015)
arXiv:1508.06389 [cond-mat.str-el]
arXiv:1510.07816 [cond-mat.str-el]
arXiv:1512.02080 [cond-mat.str-el]

About the Speaker

Ziyang Meng obtained his B.S. degree in physics from University of Science and Technology of China in 2005, and got his Ph.D. degree from University of Stuttgart in 2011. From 2011 to 2013, he worked as postdoctal research fellow with supervisors Prof. Mark Jarrell in Louisiana State University, and then in University of Toronto with supervisor Prof. Hae-Young Kee from 2013 to 2014. He has been an associate professor Institute of Physics, Chinese Academy of Sciences since 2014. His research interests currently focus on Strongly correlated electronic systems and Computational condensed matter physics.