Correlation effects on topological insulators -a dynamical mean field approach -

Tsuneya Yoshida, Robert Peters, Satoshi Fujimoto, and Norio Kawakami
Department of physics Kyoto University
yoshida@scphys.kyoto-u.ac.jp

Recently, realizations of topological phases are theoretically proposed for *d*- and *f*-electron systems (e.g. Iridium oxides[1], Heusler compounds[2,3] and filled skutterudites[4]). In such systems, electron correlations under the non-trivial conditions are expected to trigger exotic phenomena, and correlation effects on topological insulators are extensively studied [5].

We have analyzed correlation effects on a topological band insulator (TBI) by applying the dynamical mean-field theory to a generalized Bernevig-Hughes-Zhang model having the local Coulomb interaction. It is elucidated how the correlation effects modify electronic properties in the TBI phase at finite temperatures. In particular, a renormalized spin orbit coupling inevitably leads to large reduction of the spectral gap, which results in the strong temperature dependence of the spin Hall conductivity. We clarify that a phase transition from the TBI to a topologically trivial Mott insulator, if it is nonmagnetic, is of first order with a hysteresis. This is confirmed via the interaction dependence of the double occupancy and the spectral function [6]. If time allows, we will also discuss topological phases in heavy fermion systems and in one dimensional systems.

Reference:

[1] A. Shitade *et al.,* Phys. Rev. Lett. 102, 256403 (2009).
[2] S. Chadov *et al.,* Nat. Mater. 9 541 (2010).
[3] H. Lin *et al.,* Nat. Mater. 9 546 (2010).
[4] B. Yan *et al.,* Phys. Rev. B 85 165125 (2012).
[5] M. Hohenadler *et al.*, J. Phys.: Condens. Matter 25 143201.
[6] T. Yoshida *et al.*, Phys. Rev. B 85 125113.