

# 凝縮系物理学ゼミナール

## Condensed Matter Seminar

Location: Room 413, School of Science Bldg. 5 (理学5号館413号室)

Date: 13:30–15:00, Wednesday, 25 April 2012

### A Study of Correlated Topological Insulators at Finite Temperatures

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#### Abstract:

Recently, realizations of topological phases are theoretically proposed in  $d$ - and  $f$ -electron systems (e.g. Iridium oxides, Heusler compounds and filled skutterudites) [1-3], and correlation effects on topological insulators are extensively studied.

We analyze the effects of the local Coulomb interaction on a topological band insulator (TBI) by applying the dynamical mean-field theory to a generalized Bernevig-Hughes-Zhang model having local Coulomb interaction. It is elucidated how the correlation effects modify electronic properties in the TBI phase at finite temperatures. In particular, the band inversion character of the TBI inevitably leads to the large reduction of the spectral gap via the renormalization effect, 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 [4]. A magnetic instability is also addressed.

#### Reference:

- [1] A. Shitade *et al.*, Phys. Rev. Lett. **102**, 256403 (2009).
- [2] S. Chadov *et al.*, Nature Materials **9** 541–545 (2010).
- [3] B. Yan *et al.*, arXiv 1104.0641.
- [4] T. Yoshida *et al.*, Phys. Rev. B **85** 125113.