

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, 12 December 2012

“Proximity effects in a Mott/topological insulators heterostructure”

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Abstract:

Recent theoretical and experimental efforts have revealed that heterostructures of strongly correlated materials show intriguing interface-specific phenomena due to the electronic reconstruction, which results from the interplay of the electron correlation and the charge redistribution, or proximity effects [1,2,3].

In order to get further insight into the nature of the correlated heterostructures, we theoretically study an interface of the two-dimensional topological insulator and Mott insulator within the framework of the inhomogeneous dynamical-mean-field theory. We find that a helical edge state, characteristic of the interface between topologically trivial and non-trivial materials, penetrates into the Mott insulator and induces a strongly renormalized in-gap state. Intriguingly, we elucidate that such an in-gap state for the Mott insulating region also displays the helical energy-spectrum. To clarify the interplay between the electron correlation effects and the proximity effects around the interface, we modify the magnitude of the transfer integral between Mott and topological insulating regions, and find that the band reconstruction at the interface enhances the renormalization effect inside the Mott insulating region.

References:

- [1] S. Okamoto and A. Millis, *Nature* **428**, 630 (2004).
- [2] R. W. Helmes, T.A. Costi, and A. Rosch, *Phys. Rev. Lett.* **101**, 066802 (2008).
- [3] S. Ueda, N. Kawakami, and M. Sigrist, *Phys. Rev. B* **85**, 235112 (2012).