



筑波大学

*University of Tsukuba*

# Condensed Matter Seminar 物性論セミナー

2023年6月29日 (木), June 29 (Thu.) 2023

10:30-11:30 Zoom

<https://us02web.zoom.us/j/88914003345?pwd=S096bldkZkd6QTNSL2h2WTI3d0RSdz09>

Meeting ID: 889 1400 3345

Passcode: 662572

## Why monopole becomes dyon in topological insulators

Hidenori Fukaya  
Osaka University

### Abstract:

The Witten effect predicts that a magnetic monopole acquires a fractional electric charge inside topological insulators. In this work, we give a microscopic description of this phenomenon, as well as an analogous two-dimensional system with a vortex. We solve the Dirac equation of electron field both analytically in continuum and numerically on a lattice, by adding the Wilson term and smearing the gauge field within a finite range to regularize the short-distance behavior of the system. Our results reveal that the Wilson term induces a strong positive mass shift, creating a domain-wall around the monopole/vortex. This small, yet finite-sized domain-wall localizes the chiral zero modes and ensures their stability through the Atiyah-Singer index theorem, whose cobordism invariance is crucial in explaining why the electric charge is fractional. This talk is based on a work <https://arxiv.org/abs/2304.13954> in collaboration with Shoto Aoki, Naoto Kan, Mikito Koshino and, Yoshiyuki Matsuki.

Contact : Y. Hatsugai, 初貝安弘 Email: [hatsugai@rhodia.ph.tsukuba.ac.jp](mailto:hatsugai@rhodia.ph.tsukuba.ac.jp)