筑波大学
University of Tsukuba

Condensed Matter Seminar
物性論セミナー

Supported by Variety and universality of bulk-edge correspondence in topological phases: From solid state physics to transdisciplinary concepts
Grant-in-Aid for Scientific Research (S) Project No.17H06138

2019年9月18日 (水), September 18 (Wed), 2019 13:30-14:30
自然系学系棟D棟3階: 301号室
[地図]

Chiral-symmetry protected second-order topological phases

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Second-order topological insulators have drawn research interests as new topological phases. While many of the nontrivial second-order topology stem from crystal symmetry, second-order topological phases are realizable within the Altland-Zirnbauer classes [1-3]. However, it is generally difficult to construct the second-order topological phases without using crystal symmetries because we have to investigate not only the bulk topology but also the edge/surface topology.

In this presentation, we discuss second-order topological phases protected only by chiral symmetry [4]. We first introduce a simple method to construct two-dimensional second-order topological insulators protected by chiral symmetry [2,3], and study the topological phase transitions. By using the theory of the phase transition, we propose second-order topological semimetals with hinge states in three-dimensional chiral-symmetric systems. Various second-order topological semimetals can be obtained from the stacked two-dimensional second-order topological insulators. We show that one of the topological semimetals is unique to three-dimensional systems with chiral symmetry. Moreover, we show that broken chiral symmetry can realize a second-order topological insulator from the second-order topological semimetal. Finally, we demonstrate the second-order topological phases by constructing a lattice model.

[1] J. Langbehn, et al. Phys. Rev. Lett. **119**, 246401 (2017).
[2] S. Hayashi, Commun. Math. Phys. **364**, 343 (2018).
[3] S. Hayashi, Lett. Math. Phys. (2019), 10.1007/s11005-019-01184-w.
[4] R. Okugawa, S. Hayashi, and T. Nakanishi, arXiv:1907.01153.

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