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**, Thursday, 9 August 2018

“Topological properties of magnetically ordered heavy-fermion systems in the presence of mirror symmetry”

Speaker:

Kazuhiro Kimura (Condensed Matter Theory Group)

Abstract:

The concept of topology in condensed matter physics has been widely recognized since the theoretical discovery of topological insulators by Kane and Mele. Non-trivial topological properties of bulk wave function lead to metallic surface (edge) states, topological megnetoelectric effects, etc. Furthermore, there have been some intriguing extensions to Weyl semi-metals and topological crystalline insulators. The topological properties in weakly correlated electron systems have been clarified rather well. Recently, the electron correlation effects on topological properties have attracted much attention because of nontrivial features that weakly correlated electron systems do not show, such as topological Kondo insulators, interaction-reduced classifications, long-range-ordered phases in topological insulators, etc.

We here address the topological properties of magnetically ordered phases. There have been several studies on this topic: an antiferromagnetic topological insulator [1] that is realized in the combined symmetry of primitive-lattice translation and time-reversal, and a spin-selective topological insulator [2] that is realized in a spin-conserved half-metallic ferromagnetic phase of heavy-fermion system. In the previous research, such topological properties have been considered without taking spatial symmetry into account, and therefore a natural question arises: what happens if we take into account a specific spatial symmetry. We study topological properties of magnetically ordered phases by taking into account mirror symmetry in heavy-fermion systems. We analyze an effective model of the topological Kondo insulator SmB_6 in a two-dimensional square lattice, and find the following two states [3]: a two-dimensional antiferromagnetic topological state at half-filing characterized by a mirror Chern number and a topological state in a half-metallic ferromagnetic phase around quarter-filling characterized by a Chern number.

References:

[1] R. S. K. Mong, A. M. Essin, and J. E. Moore, Phys. Rev. B **81**, 245209 (2010).

[2] T. Yoshida, R. Peters, S. Fujimoto, and N. Kawakami, Phys. Rev. B **87**, 165109 (2013).

[3] K. Kimura, T. Yoshida, and N. Kawakami, arXiv:1804.01027.