

# 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, 6 December 2017

### “ $Z_4$ Topological Superconductor UCoGe”

Speaker:

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Abstract:

Emergent topologically nontrivial structure in superconductors (SCs), namely topological superconductivity, has attracted great attention in these days [1]. Recent studies have revealed that topological properties may also arise in SCs owing to the presence of crystalline symmetries [2]. Among such superconducting phases, those enriched by nonsymmorphic (NSM) crystalline symmetries, dubbed topological NSM crystalline superconductivity (TNCS), would be the most fascinating, because of the possible presence of *Möbius*- or *hourglass*-shaped surface states unique to NSM systems [3].

Interestingly, some of TNCS are classified into  $Z_4$  topological phases, which cannot be achieved in symmorphic SCs [3]. However, material realization of such TNCS has been lacking, to the best of our knowledge. Here, we propose the paramagnetic superconducting phase of UCoGe under pressure [4] as a promising candidate of TNCS with nontrivial  $Z_4$  indices. We clarify the glide topological invariants on the Brillouin-zone faces are evaluated with Fermi-surface information, and demonstrate topological invariants take nontrivial values for Fermi surfaces of UCoGe previously obtained by an *ab-initio* calculation [5]. We check our predictions by tight-binding model calculations, and illustrate the  $4\pi$ -periodic surface states.

References:

- [1] X.-L. Qi and S.-C. Zhang, Rev. Mod. Phys. **83**, 1057 (2011).
- [2] K. Shiozaki and M. Sato, Phys. Rev. B **90**, 165114 (2014).
- [3] K. Shiozaki, M. Sato, and K. Gomi, Phys. Rev. B **93**, 195413 (2016).
- [4] E. Sloaten *et al.*, Phys. Rev. Lett. **103**, 097003 (2009).
- [5] S. Fujimori *et al.*, Phys. Rev. B **91**, 174503 (2015).