

# 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)

Time and date: 13:30 – 15:00, Wednesday, 28 May 2014

### Topology of insulators and superconductors with additional order-two symmetry

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#### Abstract:

Topological crystalline insulators and superconductors are gapped free fermion topological phases protected by space group symmetries, besides any of ten classes of symmetries defined by time-reversal symmetry and particle-hole symmetry. In this seminar, we show the classification of topological crystalline insulators and superconductors with an additional order-two point group symmetry. The additional order-two point group symmetry we consider is general and it includes  $Z_2$  global symmetry, mirror reflection, two-fold rotation, inversion, and their anti-unitary symmetries (such as magnetic point group symmetry), and also their "anti-symmetries" that anticommutes with Hamiltonians. The additional order-two symmetry provides an additional generator of the Clifford algebra and shifts classifying spaces of Hamiltonians. We can construct the dimensional hierarchy of the K-groups with the additional symmetry. We find that the topological periodic table shows a novel periodicity in the number of flipped coordinates under the order-two spatial symmetry, in addition to the Bott-periodicity in the space dimensions. Various symmetry protected topological phases and gapless modes will be identified and discussed in a unified framework. Obtained K-groups suggest that defect zero modes can be considered as boundary states of lower-dimensional crystalline insulators and superconductors. We also present topological classification of symmetry protected Fermi points. The bulk classification and the surface Fermi point classification provide a novel realization of the bulk-boundary correspondence in terms of the K-theory.

#### Reference:

KS and Masatoshi Sato, arXiv:1403.3331.