

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, 18 April 2012

Effect of quasiperiodic lattice modulation on a topological superconductor with end Majorana fermions

Speaker: **Masaki Tezuka** (手塚 真樹) (Dept. of Physics, Kyoto Univ.)

Abstract:

The edge states of topologically nontrivial systems have attracted attention because they are stable against weak perturbations that do not change the topology of their quantum state. Majorana surface states can form at the boundaries or vortex cores of topological superconductors (TSs) and there has been a large amount of effort to observe such states.

We study the condition for a TS phase with end Majorana fermions to appear when a quasiperiodic lattice modulation is applied to a one-dimensional quantum wire with strong spin-orbit interaction situated under a magnetic field and in proximity to a superconductor.

By numerical analysis we find that multiple topological phases with Majorana end modes are realized in finite ranges of the filling factor, showing a sequence of reentrant transitions as the chemical potential is tuned. The locations of these phases reflect the structure of bands in the non-interacting case, which exhibits a distinct self-similar structure that we call the double Hofstadter butterfly. We also briefly discuss the stability of the TS in the presence of an on-site interaction or a harmonic trap potential.

Reference:

- [1] M. Tezuka and N. Kawakami, arXiv: 1202.5969
(to appear in Phys. Rev. B Rapid Communications)