

# 凝縮系物理学ゼミナール

## Condensed Matter Seminar

(※ seminar is held online via zoom )

Date: **13:30-15:00**, Wednesday, 8 July 2020

“Topology from interactions in the Extended Hubbard Model”

Speaker:

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Abstract:

Spontaneous symmetry breaking and symmetry-protected topological order (SPTO) constitute two major schemes by which phases of matter can be classified. While the former usually requires interactions, the latter is mainly understood in terms of winding numbers of a noninteracting bandstructure. An interplay between the two can be achieved by adding interactions to a topological bandstructure, which alters the corresponding invariants or the nature of the involved edge states. Another intriguing question is whether SPTO itself can arise from interactions, with the possibility of novel properties beyond noninteracting band topology, as a result of the richness of interacting systems.

The extended Hubbard model with an attractive density-density interaction, positive pair hopping, or both, is shown to host topological phases, with a doubly degenerate entanglement spectrum and interacting edge spins. This constitutes a novel instance of topological order which emerges from interactions. When the interaction terms combine in a charge-SU(2) symmetric fashion, a novel partially polarized pseudospin phase appears, in which the topological features of the spin degrees of freedom coexist with long-range  $\eta$ -wave superconductivity. Thus, our system provides an example of an interplay between spontaneous symmetry breaking and symmetry-protected topological order that leads to novel and unexpected properties.

### References

[1] R. Rausch, M. Peschke, *Topological phases arising from attractive interaction and pair hopping in the Extended Hubbard Model*, [New Journal of Physics \(2020\)](#).