Sonderforschungsbereich 1277

Emergent Relativistic Effects in Condensed Matter -From Fundamental Aspects to Electronic Functionality

SFB – Colloquium

- Speaker: Prof. Dr. Maciej M. Maska Wroclaw University of Science and Technology, Poland
- Tuesday, 17 January 2023, 14:15, H34 Date:
- **Topic:** Topological superconductivity driven by self-organized spin-structures

Abstract:

We study the temperature-dependent self-organization of magnetic moments coupled to itinerant electrons in finite-size low-dimensional nanostructures proximitized to a superconducting reservoir. At low temperatures, an effective RKKY-type interaction between the localized magnetic moments, which is mediated by itinerant electrons, leads to their helical ordering. This ordering, in turn, affects the itinerant electrons, inducing the topologically nontrivial superconducting phase that hosts the Majorana modes. The calculations demonstrate that the topological state can exist at least for a chain of magnetic atoms [1] and for a ladder [2]. It is interesting that in the case of a ladder an unconventional topological phase transition with neither gap closing nor a change of symmetry is possible. This contradicts common assumptions that topological phase transitions in topological superconductors are accompanied by a closing of the topological gap or a change of the symmetry of the system.

[1] A. Gorczyca-Goraj, T. Domanski, and M. M. Maska, Topological superconductivity at finite temperatures in proximitized magnetic nanowires, Phys. Rev. B 99, 235430 (2019)

[2] M. M. Maska, N. Sedlmayr, A. Kobialka and T. Domanski, Unconventional topological transitions in a self-organized magnetic ladder, Phys. Rev. B 103, 235419 (2021)

> Energy landscape for different values of the chemical potential. Figure adopted from Ref. [2].









Host: PD Dr. Magdalena Marganska