# PHYSIKALISCHES KOLLOQUIUM

## Sommersemester 2025

Das Kolloquium findet (soweit nicht anders angegeben) **jeweils montags um 14:15 Uhr in Präsenz im Röntgen-Hörsaal** des Physikalischen Instituts, Hubland Campus Süd, Universität Würzburg **und online via Zoom statt**.
Zugangsdaten siehe https://www.physik.uni-wuerzburg.de/aktuelles/veranstaltungen-aus-der-physik/physikalisches-kolloquium/

**14.07.2025**

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**Topology and Origin of Complex Nano-Scale Spin Textures**

**Abstract**

Topology is a useful concept to describe material properties. In magnetism topology can arise when the spins in a material are pointing in different directions, leading to non-coplanar magnetic order. One prominent example is a magnetic skyrmion, a particle-like magnetic state in which the spins wrap the unit sphere. Such non-coplanar spin textures can arise when different magnetic interactions are competing. Another origin of non-coplanar magnetic order is geometric frustration, as for instance in antiferromagnets on a triangular lattice. Non-coplanar magnetic states feature a scalar spin chirality, which can manifest in an additional – topological– contribution to the Hall effect and an orbital magnetization. Topology can also arise in the electronic states or the band structure of condensed matter. In topological superconductors edge modes arise at boundaries to sample regions of different topological properties.

In this colloquium I will present spin-polarized scanning tunneling microscopy and spectroscopyexperiments of topological systems. I will discuss two examples of complex topological magnetic domain walls that arise in simple magnets. In one case the low symmetry of a ferromagnet enables the formation of meron-antimeron domain walls, which transition into chains of skyrmions in applied magnetic fields. In the other case the high

symmetry of an antiferromagnet enables a non-coplanar superposition state at the regions where three adjacent rotational domains meet. When magnetic films are in contact with superconductors topological properties can emerge. Such magnet- superconductor hybrid (MSH) systems can show low energy edge modes at the boundary to the pristine superconductor. Here I will show that also boundaries between two MSHs with the same magnetic state can exhibit chiral edge modes and experiments demonstrate that they are spin-polarized.

Für die Dozentinnen bzw. Dozenten der Fakultät

Prof. Dr. Hankiewicz, Prof. Dr. Hinkov, Dr. Meyer, Dr. Feichtner, Hr. Baumbach