Walther-Meißner-Institut
Bayerische Akademie der Wissenschaften

Summer Term 2025

Walther-Meißner-Seminar

Walther-Meißner-Institut, Seminar Room 143
(Zoom Meeting ID: 617 5261 1573, Passcode 825068)

Date: **Friday, 22 August 2025, 11:15 h**

Speaker: **Johanna Fischer**
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Title: **From antiferromagnetic spintronics, multiferroics and skyrmions to highly sensitive magnetic field sensors**

Abstract:
The field of spintronics is remarkably diverse in terms of material properties and potential applications. Despite this variety, certain fundamental concepts—such as magnetic domains and their internal magnetic ordering, whether ferromagnetic or antiferromagnetic—exhibit notable similarities across systems. My research is centred on probing and understanding this magnetic ordering, with particular emphasis on domain dynamics and their deterministic control, which is critical for prospective applications.
In this talk, I will discuss distinct magnetic textures from antiferromagnetic domains [1] over multiferroics cycloids in labyrinthine ferroelectric patterns [2] to skyrmions in ferromagnetic double wedge bilayer structures [3]. I will take a broad perspective to identify the underlying commonalities. After the fabrication of such magnetic multilayer thin films, it is key to this research to find magnetometry techniques able to spatially resolve the magnetic ordering. Furthermore, I will show deterministic control of the magnetic textures via (i) multiferroic coupling, combined with epitaxial strain and ferroelectric domain reversal [2], (ii) current induced motion due to spin-orbit coupling and (iii) gate tuned magnetoionic effects [3]. Building on this I will highlight the intrinsic potential of the very soft ferromagnetic materials to function as sensing elements in high-sensitivity magnetic field sensors used in a wide range of applications, from geomagnetic field mapping to magneto-physiology [4].

[1] J. Fischer et al., Phys. Rev. B **97**, 014417 (2018); J. Fischer et al., Phys. Rev. Applied **13**, 014019 (2020); S. Geprägs et al., Journal of Applied Physics **127**, 243902 (2020).
[2] A. Haykal*, J. Fischer* et al., Nat. Commun. **11**, 1704 (2020); P. Dufour et al., Nano Lett. **23**, 9073 (2023); A. Chaudron et al., Nat. Mater. **23**, 905 (2024).
[3] C.E. Fillion et al., Nat. Commun. **13**, 5257 (2022).
[4] M. Pannetier-Lecoeur & C. Fermon, "Magnetic Sensors", in *Handbook of Magnetism and Magnetic Materials*, p. 1527-1551, edited by J.M.D. Coey and S.S.P. Parkin (Springer, 2021).