



CRC/TRR 270

HoMMage



UNIVERSITÄT
DUISBURG
ESSEN

Offen im Denken

Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 21 October 2025, 9:00 s.t., @ UDE and via Zoom



Prof. Dr. Dennis Meier
Universität Duisburg-Essen

Functional topological solitons in ferroics

Abstract:

Ferroic materials exhibit a broad range of tunable phenomena, including magnetism, multiferroicity, and superconductivity. Topological solitons in ferroics – such as dislocations, skyrmions, and domain walls – are particularly intriguing, giving a new dimension to property engineering of functional materials. The solitons locally lower the symmetry and are highly responsive to external stimuli, enabling unusual physical effects and dynamic control.

In this talk, I will discuss unique nanoscale effects driven by topological solitons in ferroics with electric and magnetic long-range order. To illustrate how these solitons govern local material behavior, I will present two examples: (i) ferroelectric domain walls in ErMnO_3 and (ii) helimagnetic edge dislocations in FeGe . To investigate these solitons, we apply a suite of advanced imaging techniques, including scanning probe microscopy, electron microscopy and atom probe tomography. Due to their emergent functionalities, the electric and magnetic solitons hold great promise for future technology, enabling conceptually new pathways towards atomic-scale nanoelectronics and low-energy information processing.

About the speaker:

Dennis Meier is Professor at the Department of Physics at the University of Duisburg-Essen, Germany, where he is heading the Functional Ferroic Systems group. He further holds an Adjunct-Professorship at the Department of Materials Science and Engineering at the Norwegian University of Science and Technology (NTNU) and is associated member of QuSpin, the Centre of Excellence for Quantum Spintronics at the Department of Physics at NTNU. Meier received his Ph.D. in 2010 from the University of Bonn, Germany. He worked at UC Berkeley (US) and ETH Zurich (Switzerland), before joining NTNU (Norway). He is the Vice-President of the European Magnetism Association (EMA) and serves in different positions, including the advisory boards of the European Meeting on Ferroelectricity (EMF), the International Conference on Electroceramics (ICE), the International Symposium on Ferroic Domains (ISFD) and the European Conference on Application of Polar Dielectrics (ECAPD). Furthermore, Meier is editorial board member at Communication Physics and Materials Today Quantum and elected member of the Royal Norwegian Society of Sciences and Letters and the Norwegian Academy of Technological Sciences. Recent honors include awards from the German Physical Society, the Norwegian Academy of Science and Letters, and an ERC Consolidator Grant from the European Research Council.