



CRC/TRR 270



TECHNISCHE  
UNIVERSITÄT  
DARMSTADT

# HoMMage

UNIVERSITÄT  
DUISBURG  
ESSEN

Offen im Denken

## Hysteresis Design of Magnetic Materials for Efficient Energy Conversion

Tuesday, 04 May 2021, 9:00 s.t., UDE, Zoom



**Prof. Karin Everschor-Sitte**

**Faculty of Physics,  
University of Duisburg-Essen**

### MAGNETIC SKYRMIONS FOR UNCONVENTIONAL COMPUTING AND REVEALING LATENT INFORMATION

#### Abstract:

Novel computational paradigms in combination with proper hardware solutions are required to overcome the limitations of our state-of-the-art computer technology. [1-3] In this talk, I will focus on the potential of topologically stabilized magnetic whirls – so-called skyrmions for reservoir computing. Reservoir computing is a computational scheme that allows to drastically simplify spatial-temporal recognition tasks. We have shown that random skyrmion fabrics provide a suitable physical implementation of the reservoir [4,5] and allow to classify patterns via their complex resistance responses either by tracing the signal over time or by a single spatially resolved measurement. [6]

In a second part of the talk I will introduce two new data analysis tools. While often a significant effort is made in enhancing the resolution of an experimental technique to obtain further insight into the sample and its physical properties, an advantageous data analysis has the potential to provide deep insights into given data set. [7, 8]

- [1] J. Grollier, D. Querlioz, K.Y. Camsari, KES, S. Fukami, M.D. Stiles, Nat. Elect. 3, 360 (2020)
- [2] E. Vedmedenko, R. Kawakami, D. Sheka, ..., KES, et al., J. of Phys. D 53, 453001 (2020)
- [3] G. Finocchio, M. Di Ventra, K.Y. Camsari, KES, P. K. Amiri, Z. Zeng, JMMM 521, 167506 (2021)
- [4] D. Prychynenko, M. Sitte, et al, KES, Phys. Rev. Appl. 9, 014034 (2018)
- [5] G. Bourianoff, D. Pinna, M. Sitte and KES, AIP Adv. 8, 055602 (2018)
- [6] D. Pinna, G. Bourianoff and KES, Phys. Rev. Appl. 14, 054020 (2020)
- [7] I. Horenko, D. Rodrigues, T. O’Kane and KES, arXiv:1907.04601
- [8] D. Rodrigues, KES, S. Gerber, I. Horenko, iScience 24, 102171 (2021)

#### About the speaker:

- Current position (starting April 2021): Professor at University of Duisburg-Essen
- 2016-2021 Head of Emmy-Noether research group “TWIST – Topological Whirls In SpinTronics”, Johannes Gutenberg University Mainz, Germany
- Postdocs:
  - 2012 – 2013 Technical University Munich, in the group of Christian Pfleiderer.
  - 2013 – 2015 Postdoctoral fellowship with DAAD, The University of Texas at Austin, US, in the group of Allan MacDonald.
  - 2015 –2016 Johannes Gutenberg University Mainz, Germany, in the group of Jairo Sinova.
- PhD: 2012 University of Cologne, Germany on “Current-Induced Dynamics of Chiral Magnetic Structures – Skyrmions, Emergent Electrodynamics and Spin-Transfer-Torques” with Achim Rosch
- Her main scientific field is the complex fundamental physics of topological magnetic textures with emphasis on magnetic skyrmions. Within the last years she has expanded her research direction towards spintronics-based unconventional computing

**CRC/TRR 270 • Technische Universität Darmstadt and Universität Duisburg-Essen**  
**Spokesperson: Prof. Dr. Oliver Gutfleisch • Co-Spokesperson: Prof. Dr. Michael Farle**  
**Management: Dr. Sonja Laubach • L2|07 110 • sonja.laubach@tu-darmstadt.de • +49 (0)6151 16-22153**  
**Address: CRC/TRR 270 • TU Darmstadt • Alarich-Weiss-Str. 16 • 64287 Darmstadt**