On-line SPICE-SPIN+X Seminars

SPIN PHENOMENA INTERDISCIPLINARY CENTER
SPIN+X SFB/TRR 173 Kaiserslautern • Mainz

Wednesday, 2nd November 2022, 15:00 (CET)

The seminar will be via Zoom (Meeting ID: 844 5243 1564) and live streamed in the SPICE YouTube Channel.

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Stripe domain phases in chiral magnetic systems with perpendicular anisotropy

Stripe domain phases arise in magnetic films with perpendicular magnetic anisotropy due to the competition between long-range dipolar fields and short-range exchange and have been studied dating back to the early work of Kittel [1] in the 1940s. Introducing interfacial Dzyaloshinskii-Moriya interactions (DMI) to the system alters the energy balance by lowering the domain wall energy and further fixes the chirality of the domain walls. These both effect the magnetic response of the stripe phase to fields, currents, and temperature. I will first discuss the implications of DMI on the stripe domain phase in a Pt/Co/Ni-based multilayer structures and their response to magnetic field and electrical current pulses [2, 3]. In particular, I will discuss the novel growth direction symmetries of the stripe phase in response to a combined in-plane and out-of-plane magnetic fields [3]. I will then discuss of the emergence of the stripe phase in ultrathin ferromagnetic layers in Pt/Co and related structures [4]. This results from low ferromagnetic exchange stiffness that lowers the domain wall energies and triggers a domain morphological transition either by changing temperature or magnetic layer thickness. This transition is accompanied by two distinct types of temperature-dependent fluctuations – faster-scale fluctuations in the domain wall positions and slower-scale fluctuations in the configuration of the overall stripe domain morphology. While the domain wall fluctuations demonstrate properties of Brownian motion modified by a sporadic pinning potential, the slower-scale morphological fluctuations exhibit characteristics typically ascribed to more solid-like, collective dynamics. At higher temperatures, these results suggest a novel fluctuating stripe phase emerges.

[1]. C. Kittel, Phys. Rev. 70, 965; (1946) and Rev. Mod. Phys. 21, 541 (1949)
[2]. J. A. Brock et al., Phys. Rev. Mater. 4, 104409 (2020)
[3]. J. A. Brock et al., Adv. Mater. 33, 2101524 (2021)
[4]. J. A. Brock and E. E. Fullerton, Adv. Mater. Inter. 9, 2101708 (2022)