

Spin-wave dynamics in stripe-domain patterns in Co/Pt multilayers

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Magnetic multilayers with perpendicular magnetic anisotropy (PMA) exhibiting stripe domain patterns at remanence represent promising platforms for reconfigurable magnonics. The periodic arrangement of up and down magnetized domains acts as a natural magnonic crystal, enabling control over spin-wave propagation without the need for nanopatterning. Spin-wave dynamics in stripe domain systems have been investigated in ferromagnetically coupled multilayers [1,2]. In this work, we study two types of samples: $[\text{Co}(3 \text{ nm})/\text{Pt}(0.6 \text{ nm})]_{\times 30}$ and $[\text{Co}(1 \text{ nm})/\text{Pt}(0.6 \text{ nm})]_{\times 10}$ multilayers. The static magnetic configurations are characterized using magnetic force microscopy. Spin-wave dynamics are probed by Brillouin light scattering spectroscopy for wave vectors oriented parallel and perpendicular to the stripe domains, corresponding to propagation along and across the domain pattern, respectively.

Our measurements reveal distinct spin-wave spectra depending on both the sample structure and the propagation direction relative to the domain orientation. To gain deeper insight into the observed spectral features and to enable a comprehensive comparison of the investigated factors, we complement the experimental studies with micromagnetic simulations.

References:

[1] C. Banerjee et al., Phys. Rev. B 96 (2017) 024421.

[2] A. K. Dhiman et al., APL Mater. 12 (2024) 111106.