3D vector magnetometry by polarized GISANS

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Neutron reflectivity with polarization analysis gives access to the amplitudes and directions of the magnetizations along the depth of thin film heterostructures. The information is averaged over the in-plane coordinates. With GISANS, correlations between in-plane magnetic fluctuations can be accessed at nanometre and mesoscopic length scales. Using polarization analysis, it allows full 3D vector magnetometry.

In this talk, we will present the calculation of GISANS with polarization analysis within the distorted wave Born approximation (DWBA) [1] and its application in the simulation of data obtained from a polarizing supermirror [2] and from a magnetic layer with perpendicular magnetic anisotropy [3]. Those data were collected respectively on the MARIA and KWS-3 instruments at the MLZ.

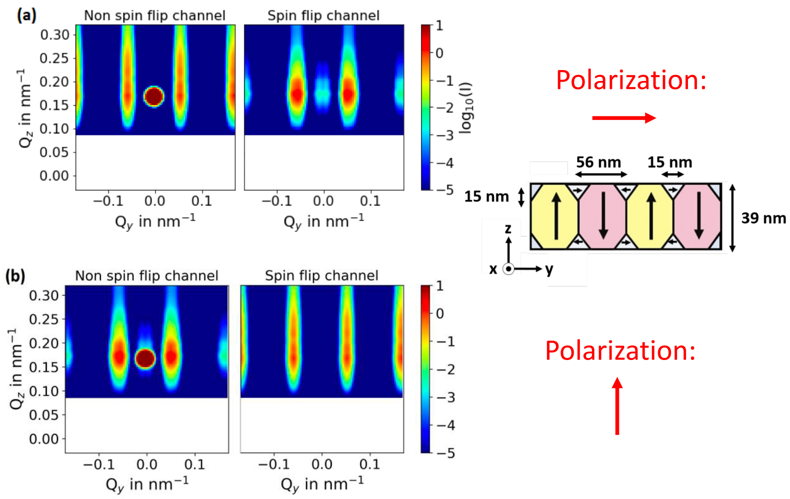

Figure 1: DWBA simulations of GISANS with polarization analysis from a magnetic layer with perpendicular anisotropy exhibiting a stripe domain structure with closure domains. The sketch on the righthand side represents a cross section of the layer perpendicular to the stripes. In (a) the polarization of the neutrons (red horizontal arrow above the sketch) is parallel to the magnetizations in the closure domains; in that case, the GISANS signal from the closure domains appears in the non-spin flip channel and the signal from the bulk of the domains appears in the spin-flip channel. Both types of signals are exchanged when the polarization (red vertical arrow below the sketch) is set parallel to the magnetizations in the bulk of the domains (b).

References

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