Spin-Disorder-Induced Angular Anisotropy in Polarized Magnetic Neutron Scattering

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We experimentally report a hitherto unseen angular anisotropy in the polarized small-angle neutron scattering (SANS) cross section of a magnetically strongly inhomogeneous material. Based on an analytical prediction using micromagnetic theory, the difference between the spin-up and spin-down SANS cross sections is expected to show a spin-disorder-induced anisotropy. The effect is particularly pronounced in inhomogeneous magnetic materials, such as nanoporous ferromagnets, magnetic nanocomposites, or steels, which exhibit large nanoscale jumps in the saturation magnetization at internal pore-matrix or particle-matrix interfaces. Analysis of the experimental neutron data constitutes a method for determining the exchange-stiffness constant. Our results for the nuclear-magnetic interference terms contained in the polarized magnetic neutron scattering cross section might also be of relevance to other neutron techniques.

References:

[1] I. Titov *et al.*, Phys. Rev. Lett. **135**, 196706 (2025)