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Unconventional magnetism in kagome magnet Co3Sn2S2

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Shandite Co3Sn2S2 has been synthesized and studied extensively, but there is still a lack of consensus regarding the magnetic ground state. Since its discovery, it has been considered a ferromagnet with c-axis as its easy axis. However, recently, there has been reports of exchange bias based on magnetometry and anomalous Hall effect attributed to spin glass and presence of antiferromagnetism at magnetic domains walls. Separately, muon spin rotation has reported an antiferromagnetic phase coexisting with a ferromagnetic phase. On the other hand, neutron scattering and non-linear optics experiments in Co3Sn2S2 have not detected phase separation between antiferromagnetic and ferromagnetic phases and instead suggest a homogenous c-axis ferromagnetic phase or a canted c-axis ferromagnetic phase, respectively. Conventional local probe techniques such as Magnetic Force Microscopy (MFM) and Magneto Optic Kerr Effect (MOKE) have not detected any antiferromagnetic phase either.

In this talk, I will present our studies on the magnetism of this material, using XMCD-PEEM and MOKE to image the magnetic domains, as well as spatially resolved Angular Resolved Photoemission Spectroscopy (ARPES) combined with Density Functional Theory (DFT) calculations to probe any electronic phase other than the ferromagnetic phase (1). If time allows, I will also present the magnetic ground state and magnetic Hamiltonian that we have derived based on neutron scattering.

1. S. Ekahana et al., Inhomogeneity in electronic phase and flat band in magnetic kagome metal Co3Sn2S2. Commun. Mater. 6, (2025).

email address

yona.soh@psi.ch

Affiliation

Paul Scherrer Institut

Author: SOH, Yona

Presenter: SOH, Yona

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