Experimentelle Physik 2

Seminar Festkörperphysik (CMP Seminar)

Aktuelle Probleme der Festkörperphysik für Studenten und Mitarbeiter
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Imaging chiral and nematic domains of continuous multi-Q manifold in triangular lattice antiferromagnets $Co_{1/3}MS_2$ (M = Ta,Nb)

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Antiferromagnetism is a fundamental mechanism that gives rise to intriguing physical phenomena, such as altermagnetism, non-collinear spintronics, and skyrmions. In this study, we investigate the Co-intercalated van der Waals material $Co_{1/3}MS_2$ (M = Ta, Nb). Recent findings reveal that this material is not a simple collinear antiferromagnet but instead exhibits spin chirality. Unlike the conventional collinear spin-up and spin-down configuration, the magnetic unit cell is extended, with spins canted relative to one another. This structure can be viewed as the short-lengthscale limit of a magnetic skyrmion lattice.

Spin chirality in this material gives rise to the anomalous Hall effect (AHE) in transport measurements. Through the same underlying mechanism, it also induces magnetic circular dichroism (MCD) in optical spectroscopy. Using spectroscopic techniques, we characterize the complex magnetic phase diagram, model real-space spin configurations, and explore the domain structure of this material. Finally, we demonstrate the opto-thermal writing of antiferromagnetic domains, offering a pathway to novel applications in spintronic devices.

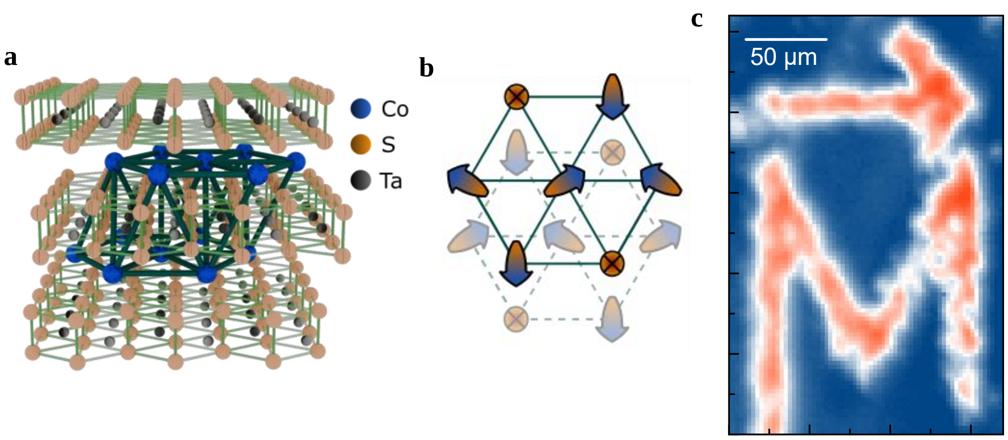

Figure 1. a) Sketch of $Co_{1/3}MS_2$ (M = Ta, Nb) b) Sketch of antiferromagnetic triple-Q spin configuration (blue color indicates canting out of plane towards viewer, orange in-plane towards page) c) opto-thermal written triple-Q domains, with red negative spin chirality, blue positive, white neutral. Scale bar 50 µm.