# HL 37: Focus Session: Physics of the van der Waals Magnetic Semiconductor CrSBr I (joint session HL/MA)

The session is the first part of the focus session on the physics of the van der Waals magnetic semiconductor CrSBr, with a main session on Friday morning. The focus session is jointly organized by HL and MA.

Time: Wednesday 15:00–15:30 Location: H15

HL 37.1 Wed 15:00 H15

**Doping-control of excitons and magnetism in few-layer CrSBr** — •Farsane Tabataba-Vakili[1,2,3], Anna Rupp[2], Huy Nguyen[2], Anvar Baimuratov[2], and Alexander Högele[2,3] — [1]Institute of Condensed Matter Physics, Technische Universität Braunschweig, Braunschweig, Germany — [2]Fakultät für Physik, Munich Quantum Center, and Center for NanoScience (CeNS), Ludwig-Maximilians-Universität München, München, Germany — [3]Munich Center for Quantum Science and Technology (MCQST), München, Germany

In two-dimensional (2D) magnets, phenomena distinct from bulk magnetism have been revealed, such as sensitivity to charge doping and electric field in few-layer CrI3. Within the class of 2D magnets, air-stable CrSBr stands out as an antiferromagnetic semiconductor with a high Néel temperature, excitons coupled to the magnetic order, and exciton-magnon coupling. In this talk, I will present our work on doping-control of excitons and magnetism in few-layer CrSBr [1]. We demonstrate that both exciton and magnetic transitions are sensitive to field-effect charging, exhibiting bound exciton-charge complexes and doping-induced metamagnetic transitions. We further visualize magnetic domain formation induced by magnetic field or charge-doping at the metamagnetic transition all-optically by raster-scan reflectance imaging. Our work identifies few-layer CrSBr as a rich platform for exploring collaborative effects of charge, optical excitations, and magnetism.

[1] F. Tabataba-Vakili et al., Nat. Commun. 15, 4735 (2024).

HL 37.2 Wed 15:15 H15

**Proximity-Induced Exchange Interaction and Prolonged Valley Lifetime in $MoSe_2$/CrSBr Van-Der-Waals Heterostructure with Orthogonal Spin Textures** — •Andreas Beer[1], Klaus Zollner[1], Caique Serati de Brito[1,2], Paulo E. Feria Junior[1], Philipp Parzefall[1], Talieh S. Ghiasi[3], Josep Ingla Aynés[3], Samuel Mañas-Valero[4], Carla Boix-Constant[4], Kenji Watanabe[5], Takashi Taniguchi[5], Jaroslav Fabian[1], Herre S. J. van der Zant[3], Yara Galvão Gobato[2], and Christian Schüller[1] — [1]UR, Regensburg, Germany — [2]UFSCar, São Carlos, Brazil — [3]TU, Delft, Netherlands — [4]ICMol, València, Spain — [5]NIMSC, Tsukuba, Japan

We report a comprehensive optical study of a ML-$MoSe_2$ on the layered A-type antiferromagnetic semiconductor CrSBr. The band alignment of the material combination is under debate. Here, we adopt the type-III band alignment picture. By performing co-circular polarized PL and reflection contrast (RC) experiments, we observe that the atomic proximity of the materials leads to an unexpected breaking of time-reversal symmetry, despite the originally perpendicular spin texture in both materials, which are further supported by first-principles calculations. Moreover, time-resolved PL and time-resolved RC measurements identify a very long-lived dynamic charge-transfer process in the heterostructure, consistent with a type-III band alignment. Our findings suggest band bending, and efficient Förster resonance energy transfer within the heterostructure. Finally time resolved Kerr ellipticity measurements reveal a two magnitudes prolonged valley lifetime.