

Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter



IMPRS UFAST Call for PhD applications 2025/2026

PM2 - Chiral electronic order: a rewindable twist for future electronics



Title of PhD Project	Chiral electronic order: a rewindable twist for future electronics
Type	Experimental
Supervisor(s)	Prof. Philip Moll Dr. Chunyu Guo
Affiliation(s):	Max Planck Institute for the Structure and Dynamics of Matter
Number of positions:	1
Abstract:	Spontaneously broken symmetries are at the heart of many phenomena of quantum matter. Intriguing examples of these electronic instabilities include different quantum materials which display the formation of an unconventional chiral charge order featuring a tantalizing charge modulation and therefore present a fantastic sandbox to probe correlated quantum phenomena. This includes the first example of switchable electronic chirality, giving the future electronics a rewindable twist. The main scope of this project is to study these exotic chiral electronic orders in mesoscopically shaped single crystals carved by focused-ion-beam machining. As is an ideal micro-fabrication tool with high precision, it minimizes the influence of extrinsic imperfections, rendering the exploration of intrinsic electronic symmetries possible. Using this technique, you will be able to explore novel non-linear response due to the electronic symmetry breaking among a series of quasi-2D transition metal dichalcogenides (TMD), including higher harmonic generation and current rectification. Most importantly, unlike the chirality bounded by crystalline structure or shape, the comparatively low energy scales of these electronic orders make them readily tunable by external perturbations. This allows you to directly control the electronic symmetry via magnetic field and strain, paving the way of realizing unique applications for future electronics, such as controllable chiral rectifier and Josephson diode.
Contact person for scientific questions about the project:	Prof. Philip Moll: philip.moll@mpsd.mpg.de Dr. Chunyu Guo: chunyu.guo@mpsd.mpg.de
Research Group Website:	https://www.mpsd.mpg.de/research/microstructured-quantum-matter

