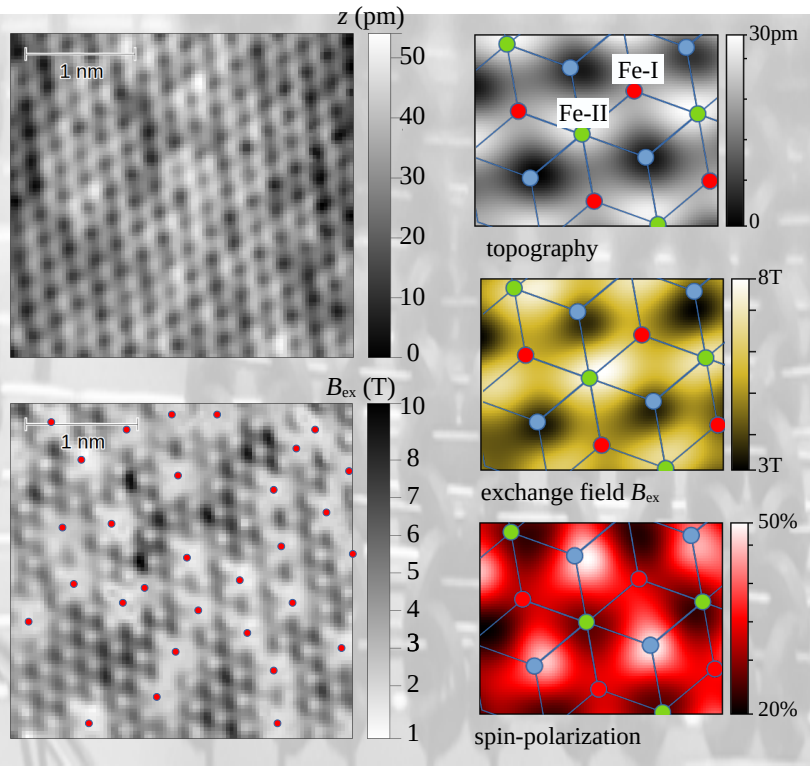
PhD thesis project:

RWTH AACHEN UNIVERSITY JÜLICH Forschungszentrum

Unconventional 2D Magnetism in Twisted vdW Heterostructures

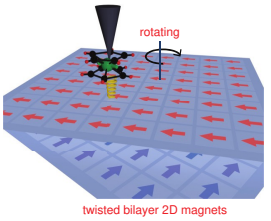
Motivation: We are seeking a PhD student to join an exciting research project in fundamental materials physics. The project focuses on understanding unconventional two-dimensional (2D) magnetism in van der Waals (vdW) hetero-structures. The project is part of the newly formed Priority Program (SPP 2558) of the German Science foundation (DFG). The goal is to study novel 2D vdW magnets, such as CrSBr and CrX_3 (X = I, Br, Cl), by stacking them with a controlled twist angle on various substrates. We then plan to use advanced scanning tunneling microscopy technology on these samples to detect their unconventional and possibly altermagnetic behavior on the atomic scale.



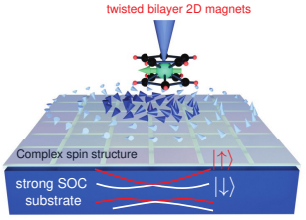
Goals: Your task is to assemble these heterostructures and characterize their electronic properties using low-temperature scanning tunneling microscopy and spectroscopy. Specifically, you will:

1) Assemble magnetic vdW structures in the controlled environment of our glove box using state-of-the-art preparation techniques, and determine their intrinsic properties at the atomic scale using scanning tunneling spectroscopy and quasiparticle interference measurements to obtain information in reciprocal space .

2) Study the impact of twisting and sliding by constructing stacked vdW materials with well-defined twist angles. Search for frustration-induced exotic magnetic phases, topological magnons and solitons, and altermagnetism or altermagnet-like spin splitting in these samples.



3) Study the Impact of proximity-induced spin-orbit coupling and superconductivity on the magnetic properties by building vdW hetrostructures. Search for magnetic noncollinearities, the influence of magnetic layers on superconductivity, and novel phenomena at the interface edges.



What will you gain? You will have the opportunity to participate in a high-quality coordinated research project. You will learn how to work in a team, how to solve cutting-edge scientific problems, and explore a novel research area. In particular, you will get:

- hands on experience on how to operate a state-of-the-art low-temperature scanning tunneling microscope
- training on working with ultra high vacuum and cryogenic equipment and how to prepare vdW heterostructures
- learn how to functionalize STM-tips using molecular manipulation techniques for magnetic sensing
- practice complex measurement schemes
- learn how to analyze experimental data and put the results in the context of physical models
- a chance to contribute to cutting-edge research

***How to contact us*:** If you are interested in this project or have any questions, please contact **Prof. Markus Ternes** (*ternes@physik.rwth-aachen.de* or *m.ternes@fz-juelich.de*)