

AG Prof. M. Morgenstern

Master Thesis



Exfoliation and characterization of magnetic 2D materials

Outline:

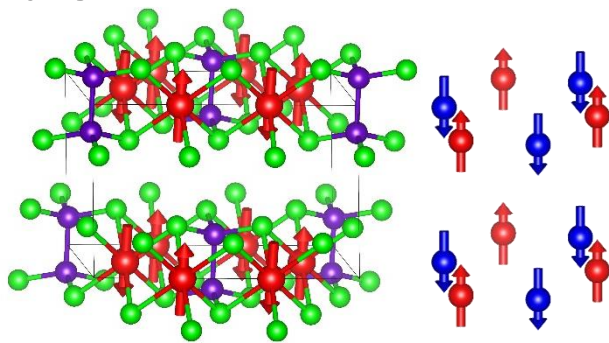
Two-dimensional materials (2DMs) can be exfoliated and transferred manually to produce novel types of devices that combine the properties of different materials such as ferromagnets, superconductors, semimetals etc.. Novel functionalities not available by standard device production lines are possible by these procedures. Moreover, these devices can be probed by high-resolution scanning tunnelling microscopy (STM) during operation, i.e. gating or current flow. This reveals unprecedented insights into the fundamentals of the functionality by probing the electronic structure with sub-meV and sub-nm resolution while quantum transport happens.

Task:

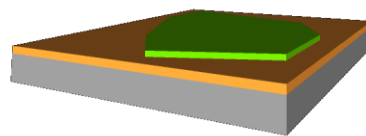
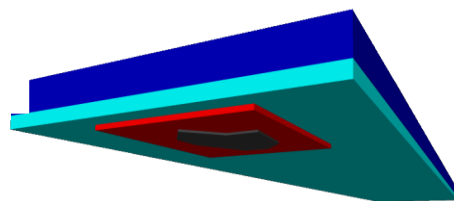
The candidate will learn to exfoliate and to transfer 2D magnetic materials in a clean room environment, mostly the antiferromagnetic thiophosphates such as $MnPS_3$, $FePS_3$ or $CrPS_4$. The exfoliated layers will be firstly analyzed by optical means, scanning force microscopy and Raman microscopy. Selected devices shall also be probed by STM in ultrahigh vacuum at 7K for probing the magnetic and electric properties with respect to the layer dependency.

Experimental skills/cleverness, dedication to optimization tasks and interest in tunable ferromagnetism are helpful to pursue the project. If you are interested in cleanroom work and characterization methods, please contact:

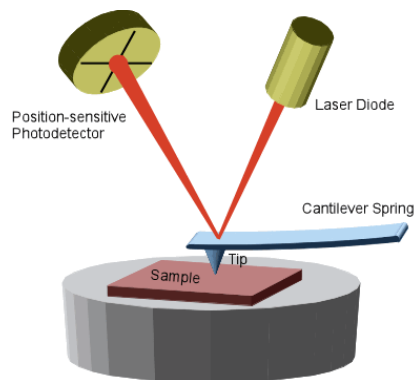
Jeff Strasdass jeff.strasdass@rwth-aachen.de or Benjamin Pestka benjamin.pestka@rwth-aachen.de



Left: atomic structure of $MnPS_3$ with Mn (red) P (violett) and S (green). Spin directions are marked by arrows. Right: only the Mn atoms.



Sketch of a transfer process of 2D materials



Sketch of an atomic force microscope

