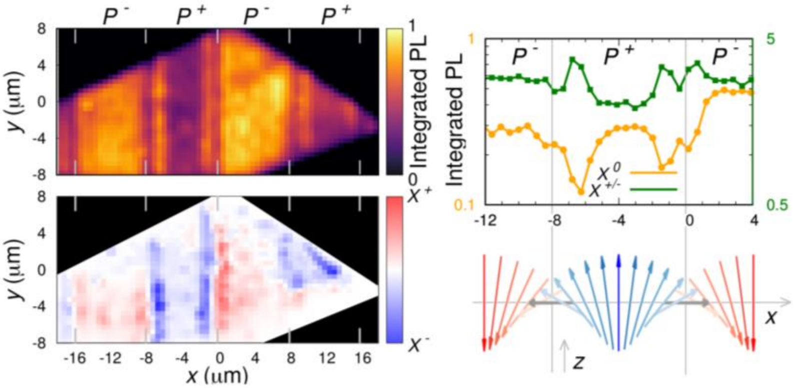
Technische Universität München

Master Thesis (SS2021 – Finley Lab)

Strong correlations at interfaces of 2D materials

The field of van der Waals heterostructures, which are stacks of individual atomically thin crystal sheets, has exploded in the last decade. More specifically, interfaces between two-dimensional (2D) materials and periodically polarized substrates have shown to localize charged excitons, due to the separation of charges at the one-dimensional (1D) interface. Furthermore, the strong electric fields created by the periodically polarized substrates might also lead to trapped neutral excitons along this 1D potential. This can result in a situation where excitons can interact via dipolar interactions along a line with each other, a situation where novel quantum phases are predicted.

The goal of this Master thesis is to study the optical properties of van der Waals heterostructures at polarized interfaces to examine topics such as exciton (de)localization, manybody physics and/or exciton-exciton interactions in a one-dimensional potential. You will use a periodically polarized lithium niobate (PPLN) substrate, which enables a high electric polarization in close proximity to the 2D heterostructure along a line, therefore creating a 1D confinement.



During the project you will work in close collaboration with a small team of PhD students and Postdocs, therefore both individual effort and team skills are key to drive this Master project.

Some experience in the areas of van der Waals stacking, optics, electronics, data analysis or cleanroom fabrication will be beneficial, but secondary to your personal motivation and creativity.

You should:
(1) be creative and self-driven, (2) be practically minded with a get-things-done attitude, (3) enjoy working across a wide range of tasks (optics, fabrication, coding, electronics) and (4) have an innovative mindset for finding solutions to everyday‘s physics and experimental challenges.

You will get:
(1) the chance to work on current hot-topic issues in the area of van der Waals heterostructures (2) gain highly sought after skills in the field of quantum engineered materials (3) a sound understanding of the physics in atomically thin materials and hopefully (4) get your scientific results published in a peer-reviewed journal.

Interested? Please email finley@wsi.tum.de and andreas.stier@wsi.tum.de