Technische Universität München | Arcisstraße 21 | 80333 München

Masters Thesis (WS2022 – Finley Lab)

Super-resolution quantum imaging of spin waves in magnetic 2D-materials

Spin waves – a propagating excitation of a magnetic texture – are primarily investigated as signal carriers in low-dissipation information processing applications (see I. Bertelli, et al., Sci. Adv. 2020, 6, eabd3556.). Being able to image spin waves occurring in 2D-materials is crucial to the in-depth understanding of their behavior and the subsequent development of novel quantum technology applications.

The principal goal of this Masters thesis is to image spin waves in magnetic 2D-materials with a nitrogen-vacancy (NV) center based quantum camera system utilizing a novel diamond solid immersion lens (SIL) for enhanced light collection efficiency and spatial resolution below the diffraction limit of a planar sensor geometry (compare P. Siyushev et al., Appl. Phys. Lett. 2010, 97, 241902.).

During the project you will work in close collaboration with a small team of Ph.D. students and postdocs, therefore individual effort is key to drive this Masters project.

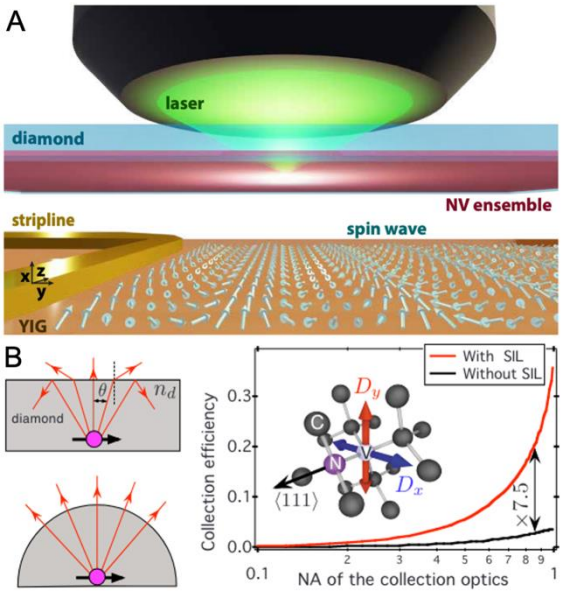

Figure 1: A) Idea of the experiment. The nitrogen vacancy (NV) centers detect the magnetic stray field generated by spin waves in magnetic 2D materials. Adapted from I. Bertelli, et al., Sci. Adv. 2020, 6, eabd3556. **B)** Diamond solid immersion lens containing NV centers demonstrating enhanced light collection efficiency and spatial resolution. Adapted from P. Siyushev et al., Appl. Phys. Lett. 2010, 97, 241902.

Some knowledge in the areas of optics or cleanroom fabrication will be beneficial, but secondary to your personal motivation and commitment to this project.

You should:

(1) Be highly motivated and self-driven, (2) be practically minded with a get-things-done attitude, (3) enjoy working across a wide range of tasks (processing, optics, electronics) and (4) be willing to work in a dedicated team on challenging things…

You will get:

(1) the chance to work on current hot-topic issues in the area of 2D van der Waals and spin wave physics, (2) gain highly sought-after abilities in the field of quantum technologies (3), a sound understanding of the physics in atomically thin materials and hopefully (4) a very, very nice paper.

Interested? Please email finley@wsi.tum.de and Andreas.Stier@wsi.tum.de

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