GDR HOWDI 2022 MEETING: SCANNING NITROGEN-VACANCY MAGNETOMETRY OF VAN DER WAALS MAGNETS

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The recent discovery of two-dimensional (2D) magnetic materials [1] has sparked wide interest in the scientific community due to their potential for a novel, atomic-scale platform hosting exotic spin-textures [2]. Advancement in this field, however, relies on quantitative knowledge of the magnetic properties of van der Waals (vdW) magnets at the nanoscale.

In this talk I will present our work on nanoscale magnetic imaging of vdW materials using a quantum sensor based on single spins in diamond, specifically the Nitrogen-Vacancy (NV) center. In our measurements we employ a scanning technique with NV centers embedded in an all-diamond scanning probe to image nanoscale magnetization patterns with a special resolution of tens of nm. We have conducted quantitative studies of magnetism in the vdW magnet chromium triiodide (CrI3) [3], where we investigated the interlayer exchange coupling in this material and shed light on the correlation between structural order and magnetization of the material. Recently, we have extended our work to other 2D magnets, specifically to in-plane magnetic systems, where we study spin textures down to the monolayer limit. Our studies provide a solid basis for future fundamental experiments on low-dimensional magnetism and open the path for studying more exotic phenomena, such as magnetic excitations (magnons) in 2D magnets.

References

[1] Huang et al., *Nature* 546, 270; C. Gong et al, *Nature* 546, 265 (2017)
[2] Gibertini et al., *Nature Nano*. 14, 408 (2019)
[3] Thiel et al., Science 364, 973 (2019)

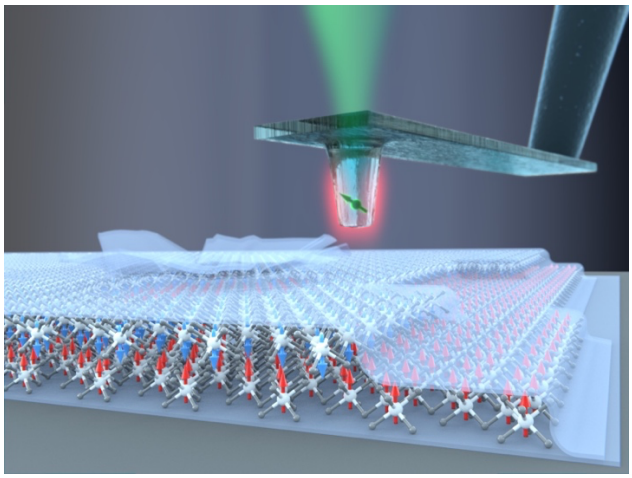

Figure 1: Nitrogen-Vacancy (NV) scanning probe technique for magnetic imaging. A single-spin NV center embedded in the tip of a diamond pillar scans over a 2D magnet while measuring the magnetic stray field.

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