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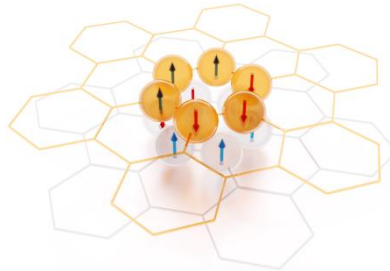
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Séminaire AXE 1 - Sciences et Matériaux Quantiques

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Engineering anti-ferromagnetic domains in atomically thin magnet

Since the first isolation of graphene in 2004, the field of van der Waals (or 2D) materials has emerged as a significant area of interest in condensed matter physics. Researchers have discovered various 2D crystals exhibiting metallic, semiconductor, and superconducting properties, and more recently [1][2] some with intrinsic magnetism. Among these newly found 2D magnets, CrSBr[3] stands out as being both an anti-ferromagnet and a semi-conductor, as well as being one of the few 2D magnets stable under ambient conditions.

Our team in Basel uses NV center magnetometry [4][5] to image the magnetic properties of thin CrSBr flakes at the nanoscale. We discovered that we could use the parts of a single flake with various thickness (2,3,4-layers etc.) to engineer magnetic textures in the flake. Notably, we achieved the creation of anti-ferromagnetic domains in CrSBr bilayers through a method we refer to as "lateral exchange bias". This demonstrates the first observation of anti-ferromagnetic domains in a 2D magnet, an important step for both fundamental physics and potential applications in spintronics.

During my talk I will introduce the NV center magnetometer that we developed in Basel, as well as the concepts that allowed us to measure and control the antiferromagnetic order in the flakes.

[1] B. Huang et al., Nature **546**, 270 (2017)
[2] C. Gong et al., Nature **546**, 265 (2017)
[3] K. Lee et al.,Nano Lett. **21**, 3511 (2021)
[4] L. Thiel et al., Science **364**, 973 (2019)
[5] M. A. Tschudin et al., Nat. Commun. **15**, 1 (2024)