

# Tailoring spins in low-dimensional systems

Samuel MAÑAS-VALERO

Department of Quantum Nanoscience, Kavli Institute of Nanoscience,  
Delft University of Technology, Delft 2628CJ, The Netherlands

E-mail: [s.manasvalero@tudelft.nl](mailto:s.manasvalero@tudelft.nl)

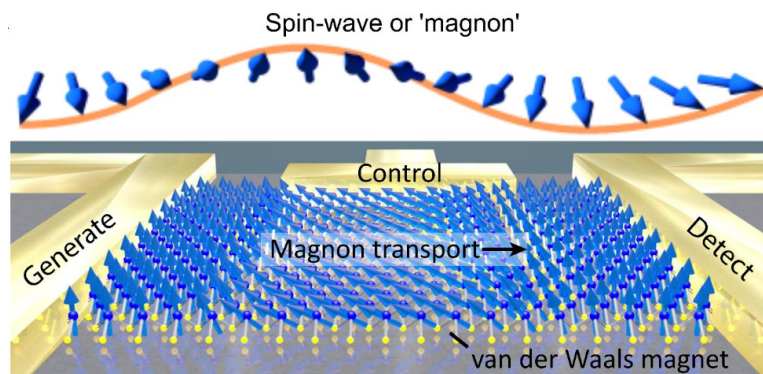
The advent of two-dimensional (2D) crystals enables the design of new devices with emergent properties. In the case of magnets, this approach can afford artificial magnets with tailored spin arrangements, bringing new directions in the design of future spintronic and magnonic devices.[1]

In this talk, I will discuss both the static and dynamic properties of low-dimensional magnetic systems.

First, I will illustrate the detection of static magnetization in 2D magnets by magneto-transport measurements and different approaches for tailoring their properties via twisting,[2] stacking[3] or molecular engineering.[4] In particular, I will focus in the van der Waals magnet CrSBr, a metamagnetic layered semiconductor formed by antiferromagnetically-coupled ferromagnetic layers ( $T_c \sim 150$  K).[5]

Second, I will consider the dynamic magnetization, that is, the excitation and detection of magnons -also known as spin-waves- in a permalloy thin-layer by diamond magnetometry.

Finally, I will summarize the future trends in magnon spintronics with low-dimensional magnets.[1]



**Figure 1. Magnonics based on Van der Waals magnets.** A) Illustration of a magnon as an excitation of a homogeneous ferromagnetic state. B) Magnon spintronics relies on manipulation and control of magnon spin transport from an injector to a detector. From [1].

## References

- [1] Fundamentals and applications of Van der Waals magnets in magnon spintronics, *Newton*, **2025**.
- [2] Multistep magnetization switching in orthogonally twisted ferromagnetic monolayers, *Nature Materials* **2024**, 23, 212.
- [3] Programmable Magnetic Hysteresis in Orthogonally-Twisted 2D CrSBr Magnets via Stacking Engineering, *Advanced Materials* **2025**, 2415774.
- [4] Strain Switching in van der Waals Heterostructures Triggered by a Spin-Crossover Metal–Organic Framework, *Advanced Materials* **2022**, 34,2110027.
- [5] Probing the Spin Dimensionality in Single-Layer CrSBr Van Der Waals Heterostructures by Magneto-Transport Measurements, *Advanced Materials* **2022**, 34, 2204940.