

## Seminar

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Thursday, July 10, 2025 

14:00 h 

RUN auditorium 1<sup>st</sup> floor 

Rupert Huber 

## ***Correlated Motions of Electrons, Spins, and Dipoles in 2D vdW Materials***

Correlation plays a central role in emergent phenomena. Examples include, among others, quantum ground states and collective excitations. Here, I will discuss what we can learn from time-domain views of correlation in two dimensional (2D) vdW materials. In the 2D vdW magnetic semiconductor, CrSBr, excitonic transition is found to strongly couple to magnetic order [1] and this allows the easy detection of low energy (GHz-THz) magnons by visible-NIR light [2]. In twisted bilayer MoTe<sub>2</sub>, we apply pump-probe spectroscopy as hitherto the most sensitive probe of many-body correlation in moiré quantum matter [3] to discover a zoo of quantum phases at fractional fillings in moiré super-lattices [4]. In the 2D vdW magnetic semiconductor, NbOI<sub>2</sub> [5], we report the experimental discovery of a quasi-particle, the ferron, which may form the basis for new modes of information processing and control [6].

1. Nature Mater. 2021, 20, 1657-1663.
2. Nature 2022, 609, 282-286.
3. Phys. Rev. Lett. 2024, 132, 126501.
4. Nature 2025, <https://doi.org/10.1038/s41586-025-08954-8>.
5. Nature Mat. 2025, <https://doi.org/10.1038/s41563-025-02201-1>.
6. Manuscript submitted.



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