

Walther-Meißner-Seminar

Walther-Meißner-Institute, Seminar Room 143

Date: Friday, 25 October 2024, ~~11:15 h~~

Speaker: **Florian Dirnberger**
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Title: **Excitons, magnons, and photons in van der Waals magnetic crystals**

Abstract:

A number of magnetic van der Waals materials was recently found to exhibit *magnetic excitons* – a rare type of optical excitations formed by spin-polarized electronic states in magnets. With properties that have no analog amongst excitons in conventional band semiconductors, these optical quasiparticles can mediate new interactions of magnetism and light.

In this talk, I will first provide an overview on magnetic excitons and how their coupling with magnons and photons brings together concepts from semiconductor physics and magnetism. The elemental role of strong light-matter coupling, and the hybridization of excitons and photons, for magneto-optical material properties will also be outlined [1,2]. In the second part, I will present our on-going efforts on understanding how magnetic order impacts the transport of these excitons with special focus on the role of crystal anisotropy and magnons. A highly non-linear exciton transport mechanism with a temperature dependence that culminates in substantially enhanced exciton propagation at the antiferromagnet-to-paramagnet phase transition will be discussed. Our observations of anomalous and effectively negative transport further indicate the substantial coupling of excitonic, vibronic, and magnetic degrees of freedom.

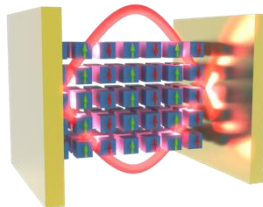


Figure: Photons confined by an optical microcavity resonator interact strongly with excitons in a van der Waals magnet.

References

- [1] F. Dirnberger, R. Bushati, B. Datta, A. Kumar, A. H. MacDonald, E. Baldini, V. M. Menon, [Spin-correlated exciton-polaritons in a van der Waals magnet](#), *Nature Nanotechnology*, **17**, 1060–1064 (2022)
- [2] F. Dirnberger, J. Quan, R. Bushati, G. Diederich, M. Florian, J. Klein, K. Mosina, Z. Sofer, X. Xu, A. Kamra, F. J. García-Vidal, A. Alù, and V. M. Menon, [Magneto-optics in a van der Waals magnet tuned by self-hybridized polaritons](#), *Nature* **620**, 533-537 (2023)