

CONDENSED MATTER THEORY SEMINAR

Subject: **Magnetic imaging of spin waves using electron spins in diamond**

Speaker: **Dr. Toeno van der Sar (TU Delft)**

Date & time: **Friday, October 23rd, 2020 at 3:15 p.m.**

Venue: **Online Seminar**

Magnetic imaging based on the electron spin of the nitrogen-vacancy (NV) defect in diamond has emerged as a new tool for probing condensed matter systems [1]. In this talk, I will introduce NV magnetometry as a platform for imaging spin waves – the elementary spin excitations of magnetic materials [2]. Using a layer of NV spins in a diamond chip that is placed onto a thin-film magnet, we visualize the spin-wave dispersion, measure spin-wave packets, and study spin-wave chirality. NV-sensing allows imaging of spin waves through optically opaque materials, enabling studies of the interaction of spin waves with magnetic and non-magnetic materials placed on top of a magnet. We use scanning-NV tips to gain access to nanoscale spin waves and characterize how driven coherent spin waves increase the spin-wave chemical potential. These techniques pave the way for imaging spin waves in monolayer magnets and open possibilities for probing optically created electronic states in monolayer semiconductors [3].

- 1) *Probing condensed matter physics with magnetometry based on nitrogen-vacancy centres in diamond*
F. Casola*, T. van der Sar*, and A. Yacoby
Nature Reviews Materials 3, 17088 (2018)
- 2) *Magnetic resonance imaging of spin-wave transport and interference in a magnetic insulator*
I. Bertelli, J. J. Carmiggelt, T. Yu, B. G. Simon, C. C. Pothoven, G. E. W. Bauer, Y. M. Blanter, J. Aarts, and T. van der Sar
Arxiv:2004.10023 (2020)
- 3) *Exciton-to-trion conversion as a control mechanism for valley polarization in room temperature monolayer WS₂*
J. J. Carmiggelt*, M. Borst*, and T. van der Sar
Arxiv:2004.07746 (2020)