Seminar announcement

Tuesday, December 20, 2022
1:30 pm
WSI, Seminar room S 101

“Nanoscale quantum sensing of antiferromagnets and 2D magnets”

Quantum two-level systems offer attractive opportunities for sensing and imaging at the nanoscale. In the fifteen years since its inception, this idea [1] has advanced from proof of concept [2] to a mature quantum technology [3,4], which already finds applications in condensed matter physics, materials science and engineering. In this talk, I will present the key engineering challenges we have addresses in this development [5] and highlight particularly rewarding applications of single-spin, scanning probe microscopy.

Specifically, I will discuss how we employ single electronic spins in diamond for nanoscale probing of antiferromagnetic systems [6-10] and high-resolution imaging of atomically thin “van der Waals” magnets [11,12]. For both, the combination of sensitivity, spatial resolution and quantitative imaging enables unprecedented insights such as quantitative imaging of nanoscale domains [9] and domain-walls [10] in antiferromagnets and nanoscale imaging of spin textures in magnetic systems down to the atomic monolayer limit [12].

I will conclude with an outlook of future developments of single spin magnetometers for extreme conditions, such as high magnetic fields, millikelvin temperatures or for high-frequency sensors to probe the dynamics of nanomagnetic systems.

[1] B. Chernobrod and G. Berman, J. of Applied Physics 97, 014903 (2004)
[2] G. Balasubmaranian et al., Nature 455, 644 (2008)
[3] P. Appel et al., Review of Scientific Instruments 87, 063703 (2016)
[4] www.qnami.com
[5] N. Hedrich et al. Phys. Rev. App., 14, 064007 (2020)
[6] T. Jungwirth et al., Nature Nanotechnology 11, 231 (2016)
[7] T. Kosub et al., Nature Communications 8, 13985 (2017)
[8] I. Gross et al., Nature 549, 252 (2017)
[9] P. Appel et al., Nano Letters 19, 1682 (2019)
[10] N. Hedrich et al., Nature Physics 17, 574 (2020)
[11] M. Gibertini et al., Nature Nanotechnology 14, 408 (2019)
[12] L. Thiel et al., Science 364, 973 (2019)

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