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Physikalisches Kolloquium

Title:	Exploring nanoscale van der Waals magnetism using single spin microscopy
Speaker:	Prof. Dr. Patrick Maletinsky, University of Basel, Switzerland
Date & time:	Friday 14.11.2025, 2 pm
Location:	ZKS-Uhrturmhörsaal, S2 08, R. 171, Hochschulstraße 4
Host:	Prof. Dr. Bernhard Urbaszek

Abstract:

Quantum two-level systems offer attractive opportunities for sensing and imaging, especially at the nanoscale.

In the almost twenty years since its inception, this idea [1] has advanced from proof of concept [2] to a mature quantum technology [3], with broad fields of applications in physics, materials engineering, life-sciences, and beyond. In this talk, I will present the founding principles and key engineering challenges in the field and highlight particularly rewarding applications of single spin-based quantum sensors. A particular focus will lie on new insights these sensors bring to mesoscopic condensed-matter physics, such as superconductors [4] or novel magnetic materials.

Here, I will focus on the use of single-spin quantum sensors to study and engineer atomically thin “van der Waals” magnets [5-7] - an emerging class of magnetically ordered systems that combine fundamental and practical interests and which so far were notoriously hard to address due to their weak magnetization and nanoscale spin-textures.

I will conclude with an outlook on future developments of quantum sensors, such as their use in studying dynamical phenomena in quantum materials [8] or their applications under extreme conditions, such as Tesla-range magnetic fields, or millikelvin temperatures, where new exciting applications wait to be explored.



- [1] B. Chernobrod and G. Berman, J. of Applied Physics 97, 014903
 - [2] G. Balasubramanian et al., Nature 455, 644; J. Maze et al., Nature 455, 644
 - [3] N. Hedrich et al. P.R. Appl., 14, 64007; P. Appel et al., Rev. Sci. Instr. 87, 63703; [Qonami.com](https://qonami.com)
 - [4] L. Thiel et al., Nature Nanotechnology 11, 677
 - [5] C. Gong and X. Zhang, Science 363, 706; M. Gibertini et al., Nature Nano. 14, 408
 - [6] L. Thiel et al., Science 364, 973
 - [7] F. Tabataba-Vakili et al., Nature Comm. 15, 4735; Tschudin et al., Nature Comm. 15, 6005
 - C. Pellet-Mary et al. arXiv:2503.04922
 - [8] J. Rovny et al., Nature Reviews Physics 6, 753
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