



TECHNISCHE UNIVERSITÄT
CHEMNITZ

Institut für Physik Physikalisches Kolloquium



Mittwoch, 12.04.2023, um 11:15 Uhr

**Ort: Reichenhainer Str. 90;
Zentrales Hörsaal- und Seminargebäude,
Raum C10.013**

Dr. Philip Willke

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GAEDE-PREISTRÄGER 2022

Quantum Science with Single Atoms and Molecules on Surfaces

The quantum nature of a physical system often emerges from its fundamental building blocks and demands a profound understanding to harvest its advantages for quantum devices. In this talk, I will introduce a new architecture for coherent control of spins on surfaces, by combining electron spin resonance (ESR) and scanning tunneling microscopy (STM) [1]. This technique allows to address single atoms and molecules on surfaces with unprecedented energy resolution. Thus, it can be used to sense the magnetic coupling between spin centers on the nanoscale [2], including their dynamics [3,4]. In addition, when scanning the STM tip across the surface it permits to perform magnetic resonance imaging on the atomic scale [5]. The high energy resolution also grants access to the hyperfine interaction between the electron and nuclear spin of different atomic species [6]. Recently, we could extend this technique also to spin resonance on individual molecules [7]. Lastly, by employing pulsed ESR schemes, a coherent manipulation of the surface spin becomes possible, for instance in Rabi and Hahn echo schemes [8]. This opens up a path towards quantum information processing and quantum sensing using atomic building blocks, including atoms and molecules.

- [1] S. Baumann, W. Paul et al., *Science* 350, 6259 (2015).
- [2] T. Choi, ..., PW, et al. *Nature Nanotechnology* 12, 420-424 (2017).
- [3] F. Natterer, ..., PW, et al., *Nature* 543, 226 (2017).
- [4] L. Veldman, L. Farinacci et al., 372, 964-968 (2021).
- [5] P. Willke et al., *Nature Physics* 15, 1005–1010 (2019).
- [6] P. Willke et al., *Science* 362, 336–339 (2018).
- [7] X. Zhang, ..., PW, et al., *Nature Chemistry* 14, 59–65 (2022).
- [8] K. Yang, ..., PW, et al., *Science* 366, 509-512 (2019).

Alle Zuhörer sind ab 11:00 Uhr zum Kaffee vor dem Hörsaal eingeladen.



Informationen zum Vortrag erteilt:
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