

Christoph Wolf

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Tuesday, 30th May 2023, 16:00 s.t.

TU Wien, Institut für Angewandte Physik, E134
1040 Wien, Wiedner Hauptstraße 8-10
Yellow Tower „B“, 5th floor, SEM.R. DB gelb 05 B



The seminar will be also held as a Zoom Meeting

<https://tuwien.zoom.us/j/96062751637?pwd=ZkRUWnlkUFFZb2pEdm55ZzFteTBNdz09>

Meeting ID: 960 6275 1637

Password: 9ANd8XWj

Towards full quantum-coherent control of coupled electron spins on a surface

In less than a decade since the first measurement of electron spin resonance (ESR) in a scanning tunneling microscope (STM) we have now achieved quantum-coherent control of individual electron spins on a surface.[1,2]

In this talk, I first want to highlight a few aspects of the ESR-STM technique, such as the ability to distinguish different isotopes by identifying the nuclear spin, the high-precision determination of the electron ground state and the measurement of exchange-coupling constants between individual molecular dimers. [3-5].

In the second part of my talk, I will introduce a new paradigm in ESR-STM that has only emerged in the past two years: *quantum coherent control*. By utilizing the sub-atomic spatial precision of the STM, we are able to build structures of only a few atoms. Using the high energy resolution we can then determine the interaction Hamiltonian and design quantum functionality in these structures. In our pioneering work [2] we have shown the possibility of quantum state control and quantum gate operations – in principle a quantum computer at the atomic scale.

[1] Baumann *et al.*, Science 350, 417 (2015)

[2] Phark *et al.*, arXiv:2108.09880

[3,4] Kim *et al.*, PRB 104 174408 (2021) and Nano Letters 22 9766 (2022)

[5] Zhang *et al.*, Nature Chemistry 14 59 (2022)

All interested colleagues are welcome to this seminar lecture
(45 min. presentation followed by discussion).

Friedrich Aumayr
(LVA-Leiter)

Ulrike Diebold
(Seminar Chair)