SFB/TRR 21 - Seminar

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Quantum correlations in atomically designed magnets

Magnetic atoms can interact with each other if they are placed into close proximity. By use of super-exchange coupling through a molecular frame such strong interaction can be achieved that the magnetic atoms respond coherently as one giant spin to external DC or AC magnetic fields. We use the tip of a low-temperature scanning tunneling microscope (STM) to address individual molecular magnets and probe their properties by inelastic electron tunneling spectroscopy and electronic pump-probe spectroscopy at GHz frequencies [1]. I will discuss two types of molecular magnets: single-molecule magnets sublimated onto a surface and atomic spin chains assembled atom by atom with the STM. Single-molecule magnets (SMMs) can be studied by far- and near-field techniques which makes it possible to deduce how coupling to electric leads impacts their magnetism providing crucial information for design of molecular spintronics devices. Atomically assembled spin chains provide a high degree of design flexibility which allows us to study fundamental concepts of quantum magnetism [2] such as the size-dependent quantum phase transition between quantum-mechanical and classical magnetism [3] and the emergence of many-body states in linear spin chains. The combination of time-resolved inelastic electron tunneling spectroscopy with the high spatial resolution of the STM provides a new toolset to explore quantum correlations at the single atom level. [1] S. Loth, M. Etzkorn, C. P. Lutz, D. M. Eigler, A. J. Heinrich, Science 329, 1628 (2010). [2] S. Yan, D. J. Choi, J. Burgess, S. Rolf-Pissarczyk, S. Loth, Nature Nanotech. 10, 40 (2014). [3] F. Delgado, S. Loth, M. Zielinski and J. Fernández-Rossier, Europhys. Lett. 109 57001 (2015).

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