北京大学量子材料科学中心
International Center for Quantum Materials, PKU

Seminar

From single atom magnets to emergence in a magnetic lattice

Fabian Donat Natterer
Ecole Polytechnique Fédérale de Lausanne

Time: 16:00pm, August 14, 2017 (Monday)
时间：2017年8月14日（周一）下午16:00
Venue: Room W563, Physics Building, Peking University
地点：北京大学物理楼 西563

Abstract

As we move from classical to quantum matter, the way we engineer the properties of our devices is radically transforming. A few centuries ago, the swift hand of a blacksmith and his yearlong experience were enough to form a blade into its desired shape and hardness. In many quantum materials, however, the properties emerge from the interaction of only a few atoms whose interactions are difficult to predict. For this reason, new ways to tailor and probe matter at the fundamental length scale are highly desired. The recent advent of single atom magnets [1] promised new opportunities. Here we demonstrate the characterization of single-atom magnets using a scanning tunneling microscope (STM) [2]. The electron paramagnetic resonance enhanced approach [3] allows us to not only control the magnetic state of a holmium single-atom magnet, but the atom manipulation capabilities of the STM enable us to also build a nanometer sized magnetic memory [2]. We examine the suppression of the quantum tunneling of magnetization [4] and the thermal stability of single-atom magnets [5]. We further explore how the non-interacting single-atom magnets may be transformed into a highly frustrated spin lattice from which new properties emerge. The local nature of the STM and the control over the magnetic state of a lattice vertex should enable the study of emergence in this spin-ice material and yield insights into the dynamics of quasi-particle properties, such as magnetic monopoles [6].

[1] Donati *et al., Science* **352**, 318 (2016)
[2] Natterer *et al.*, *Nature* **543**, 226 (2017)
[3] Baumann, Paul *et al*., *Science* **350**, 417 (2015)
[4] Gatteschi and Sessoli, *Angew. Chem. Int. Ed*. **42**, 268 (2003)
[5] Natterer *et al.*, in preparation
[6] Castelnovo *et al., Nature* **451**, 42 (2007)

About the Speaker

Fabian Natterer is a holder of an Ambizione grant offered by the Swiss National Science Foundation. He received a Diploma in Physics from the University of Vienna, Austria, and a Ph.D. in Physics from EPFL, Lausanne, Switzerland (2013). In his four years of postdoctoral research at EPFL, the National Institute of Standards and Technology (Gaithersburg, MD, USA), and at IBM Research Almaden (San Jose, CA, USA), he became an expert in the field of scanning tunneling microscopy and made important contributions to surface physics. His most significant works include: the rotational excitation of molecular hydrogen and its connection to the molecular nuclear spin states, the realization of electron confinement in graphene resonators resembling whispering gallery modes, and most recently, the reading and writing of single atom magnets. His Ambizione project at EPFL will deal with STM enabled single atom electron paramagnetic resonance for the study of atomic and molecular magnetic moments.

Host: 江颖<yjiang@pku.edu.cn>