



Seminar

Advances in single atom electron spin resonance: hyperfine interaction and magnetic resonance imaging

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Venue: Room W563, Physics Building, Peking University

地点: 北京大学物理楼 西563

Abstract

In this talk I will present our recent progress in single atom electron spin resonance (ESR) realized in a scanning tunneling microscope (STM) [1,2].

In the first part I will show that we can resolve and control the hyperfine interaction of individual atoms by using ESR-STM. Using atom manipulation to move single atoms we find that the hyperfine interaction strongly depends on the binding configuration of the atom as well as the proximity to other magnetic atoms. This allows the extraction of atom- and position-dependent information about the electronic ground state, the state mixing with neighboring atoms as well as properties of the nuclear spin. Thus, the hyperfine spectrum becomes a powerful probe of the chemical environment of individual atoms and nanostructures.

In addition, I show that we are able to extend ESR-STM to perform magnetic resonance imaging (MRI) for the first time on individual atoms. Here, we use the magnetic field of the STM tip to shift the Zeeman energy of the atom on the surface and cause spatial variations in the resonance frequency. While this is similar to existing scanning field gradient methods[3,4], our approach exceeds their spatial resolution by one to two orders of magnitude, to achieve Ångström resolution.

REFERENCES:

- [1] Baumann *et al.*, *Science* **350**, 6259 (2015).
- [2] Willke *et al.*, *Science Advances* **4**, eaag1543 (2018).
- [3] Rugar *et al.*, *Nature* **430**, 329-332 (2004).
- [4] Balasubramanian *et al.*, *Nature* **455**, 648 (2008).

About the Speaker

Professional Employment :

05/2018 - current: **Feodor-Lynen Fellow**, IBS Center for Quantum Nanoscience and Ewha Womans University, Seoul, South Korea
02/2017-04/2018: **Postdoctoral Researcher**, IBS Center for Quantum Nanoscience, and Ewha Womans University, Seoul, South Korea in collaboration with IBM Almaden Research Center, CA, USA
12/2013-01/2017: **PhD at University of Göttingen, Germany**, Scanning Tunneling Microscopy group (Dr. Martin Wenderoth)
Atomic-scale transport in graphene: the role of localized defects and substitutional doping, Grade: *Summa cum Laude*
11/2015 - 5/2016: **Research Visit**, IBM Almaden Research Center, San Jose, CA, USA

Education:

02/2012 - 11/2013: **Master of Science in Physics at University of Göttingen, Germany** Focus on Solid State and Material Physics
09/2011 - 01/2012: **General Visiting Student at Peking University**, PR China, Studying Chinese and Physics
10/2008 - 09/2011: **Bachelor of Science in Physics at University of Göttingen, Germany**