

Physics / Astrophysics
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Spintronics

Speaker:

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Scanning tunnelling spectroscopy of interacting electron systems

Solids exhibit a wealth of fascinating and surprising properties which are based on the interaction of the electrons within the solid. Due to the intricate quantum-mechanical character of the interactions, a prediction of properties is not straightforward. A microscopic approach by scanning tunneling spectroscopy performed at low temperatures and within high magnetic fields can reveal the specific arrangement of electrons in well-defined and tunable experimental situations. This can be done most systematically by the use of III-V semiconductors [1], where most of the important parameters are externally tunable. But the method can also be applied to more complicated solids [2]. The resulting exact knowledge on the microscopic behaviour of the system serves as an indispensable base for a detailed understanding of macroscopic properties. Several examples will be shown in this talk. A particular emphasis is put on the role of the spin for the electronic behaviour, which can be directly addressed by the so-called spin-polarized version of scanning tunneling spectroscopy [3].

- [1] M. Morgenstern, Surf. Rev. Lett. **10**, 933 (2003): *Probing the Local Density of States of Dilute Electron Systems in Different Dimensions*.
- [2] M. Morgenstern, A. Schwarz, and U. D. Schwarz in *Springer Nanotechnology Handbook* (ed. by B. Bushan), Springer Verlag, 2004, Chapter 14: *Low Temperature Scanning Probe Microscopy*.
- [3] M. Bode, Rep. Prog. Phys. **66**, 523 (2003): Spin-polarized scanning tunneling microscopy; A. Wachowiak, J. Wiebe, M. Bode, O. Pietzsch, M. Morgenstern, and R. Wiesendanger, Science **298**, 577 (2002): *Internal Spin-Structure of Magnetic Vortex Cores observed by Spin-Polarized Scanning Tunneling Microscopy*.