Seminář odd. 26
Tenkých vrstev a nanostruktur

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TÉMA

Mapping the spin distribution of molecules adsorbed on graphene

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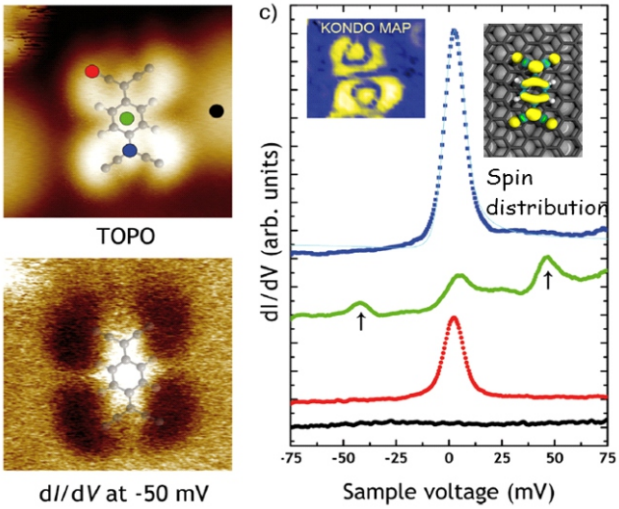
Creating an ordered 2D array of objects with protected magnetic moments deposited at surfaces, individually addressable and with potentially controlled interactions between their spins would be highly desirable for different quantum technologies. Being able to visualize the distribution in space of the spins is crucial to advance our knowledge and control of these systems. Below a certain temperature, a magnetic moment located at the surface can be screened by the electron sea of the substrate giving rise to a many body state known as Kondo resonance.

We present some selected examples to illustrate how by recording the spatial distribution of the sharp Kondo resonance at the Fermi level with Scanning Tunneling Spectroscopy at low temperatures one can visualize experimentally the spin distribution:



i) Spin distributed in a molecular orbital: isolated molecules of TCNQ/graphene/Ru(0001)1

ii) Spin localized in a bond: isolated molecules of F4-TCNQ/graphene/Ru(00101)2

iii) The turning on (and off) of localized magnetic moments by controlled, reversible reaction of an acceptor molecule (i.e. TCNQ) and a radical covalently bonded to graphene epitaxially grown on Ru(0001)3-5

The controllable production of a superconducting tip for the STM allows to explore the ultimate limit of resolution and the new physics revealed by the Zero Bias Conductance peaks in TCNQ molecules adsorbed on Pb-intercalated graphene grown on Ir(111), a substrate with a giant spin-orbit coupling.

References

[1] M. Garnica et al, Nature Physics 9, 368 (2013)
[2] M. Garnica et al, Surface Sci. 630, 356 (2014)
[3] J.J. Navarro et al, Nano Letters 16, 355 (2016)
[4] J.J Navarro et al, Chem. Comm. 53, 10418 (2017)
[5] J.J. Navarro et al, Science Advances (2018)

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