Atomic scale magnetometry with STM-ESR

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In this talk I will do two things. First, I will review the principles of a relatively new instrumental technique [1], electron spin resonance (ESR) carried out on individual on-surface atoms and molecules with a Scanning Tunneling Microscope (STM). This new technique outperforms conventional ESR in many orders of magnitude, as it can probe an individual spin, and it outperforms the spectral resolution of STM inelastic electron tunnel spectroscopy in four orders of magnitude.

I will then review our recent proposals to exploit the lateral sensing ESR-STM mode [2] (see Figure 1) for several applications. This includes entanglement witnessing in artificial spin chains on surfaces [3], probing spin fractionalization in sin chains [4] and atomic resolution thermometry [5]

References

[1] S. Baumann et al, Science, 350, (2015) 417
[2] T. Choi, Nature Nanotechnollogy 12 (2017), 420
[3] Y. del Castillo, J. Fernández-Rossier, Phys. Rev. B, 108 (2023), 115413
[4] Y. Del Castillo, J. Fernández-Rossier, arxiV:2311.15720
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Figures

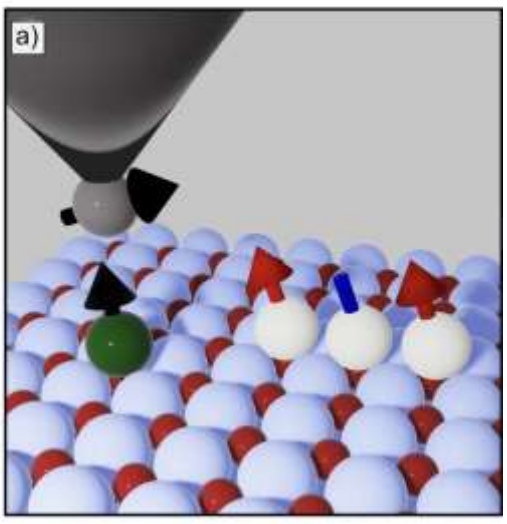

Figure 1. Scheme of the ESR-STM lateral sensing mode [2]. The spin resonance spectrum of the green atom is measured using green atom under the STM is recorded. This contains information of both the and the occupation of different quantum states of the nearby spin chain [3,4,5].