

Nuclear magnetic resonance on a single atom with a local probe

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Nuclear spins carry relevant chemical information that can be probed using nuclear magnetic resonance (NMR), a powerful characterization technique that often relies on ensemble measurements. Nuclear spins are also promising building blocks for quantum technology applications [1], owing to their long lifetimes [2] and coherence times compared to their electronic counterparts. However, their high degree of isolation poses challenges in their addressability and control.

The development of electron spin resonance (ESR) in combination with scanning tunneling microscopy (ESR-STM) has enabled the indirect measurement of nuclear spins on single atoms via the hyperfine interaction [3], as well as the ability to polarize nuclear spins using spin-polarized electrical currents [4]. In this work, we employed an electron-nuclear double resonance (ENDOR) scheme, implemented with ESR-STM to drive and read out nuclear spin transitions on a single ⁴⁷Ti isotope. The quadrupole interaction present in the system allows us to individually address several of these transitions.

References

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Figures

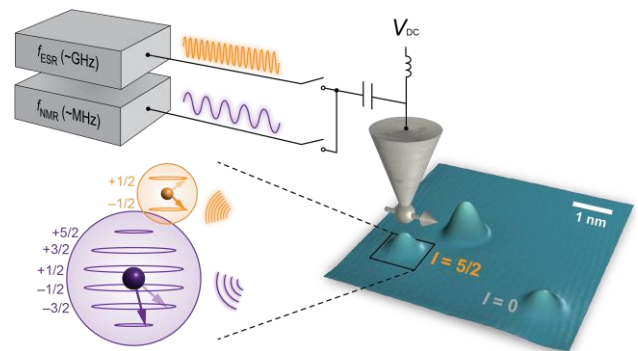


Figure 1: Electron-nuclear double resonance set-up used to perform NMR on a single ⁴⁷Ti isotope with ESR-STM.