Long-Lived Magnetic States in Single-Atom Magnets at Surfaces

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Magnetic atoms on surfaces are emerging as a new class of systems with exceptionally long spin relaxation times, which allows for reading and writing magnetic bits on the atomic scale. [1-3] The magnetic properties of the single-ion magnets depend crucially on their atomic environment and enhancing their spin dynamics may lead to the development of single-atom qubits. Recent observations of magnetic remanence in individual Ho atoms adsorbed on ultrathin MgO(100) layers on Ag(100) provided the first evidence of a single atom magnet on a surface. [1] The opening of the hysteresis loop indicates that the lifetime of Ho atoms is on the order of hours at cryogenic temperatures. Meanwhile more rare-earth adatom systems have been identified having exceptionally long spin relaxation time T_1.

Despite the raising interest in these systems, it is still not clear which factors determine their very long relaxation time and if a long coherence time can be expected. The talk highlights our recent efforts in understanding the magnetic properties of single-atom magnets on surfaces using synchroton light. We put particular emphasis on the different contributing factors to long-lived magnetic states including strong uniaxial magnetic anisotropy, symmetry protection of the ground state from quantum tunneling and other first order scattering processes as well as the peculiarities of the spin-phonon coupling with the supporting substrate.

References

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