MAR11-2010-020099

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

All-electric control of single atom spin states

SANDER OTTE, Delft University of Technology, The Netherlands

The quantum state of a single spin is a great candidate for forming a qubit. Spin systems in various forms are considered for the task, ranging from electrons trapped in artificial quantum dots to magnetic dopants in semiconductors and diamond. In this talk I will review recent progress towards controlling the spins of individual atoms on a surface through local access with an STM probe tip: an intriguing approach in view of the possibility to rearrange the atoms at will so as to build multi-atom structures. Magnetic d-metal atoms, separated from a metal substrate by a thin decoupling layer, are studied through inelastic electron tunneling spectroscopy (IETS): a tool by which transition energies of the spin state can be accurately followed. By addressing the atoms with a spin-filtered probe tip, controlled excitations or de-excitations can be made, effectively pumping the spin into a magnetization direction of choice. In a more recent experiment, spin pumping is performed in short pulses, opening up ways to control atomic spins in the time domain. I will discuss avenues to further develop this technique, eventually leading to coherent control of an atomic spin qubit.