MAR08-2007-001060
Abstract for an Invited Paper
for the MAR08 Meeting of
the American Physical Society

Probing Magnetic Nanostructures on the Atomic Scale

CYRUS F. HIRJIBEHEDIN, London Centre for Nanotechnology, Depts. of Physics & Astronomy and Chemistry, University College London

Magnetic nanostructures are increasing data storage capacities and are promising candidates for implementations of novel spin-based computation techniques. The relative simplicity and reduced dimensionality of nanoscale magnetic structures also make them attractive model systems for studying fundamental interactions between quantum spins. We used a scanning tunneling microscope to build individual magnetic nanostructures one atom at a time. By measuring their spin-excitation spectra with inelastic electron tunneling spectroscopy, we determined the orientation and strength of the anisotropies of individual Fe and Mn atoms on copper nitride. First-principles calculations indicate that the magnetic atoms become incorporated into a polar covalent surface molecular network, making them similar to the building blocks of molecular magnets. In linear chains of up to 10 Mn atoms, we observed excitations of the coupled atomic spins that can change both the total spin and its orientation. The large magnetic anisotropy and strong spin-coupling manifested in these structures, which provide atom-by-atom accessibility via local probes, have the potential to produce atomic-scale magnetic structures that have a stable magnetization at low temperatures.

* This work was done in collaboration with C.-Y. Lin, A.F. Otte, M. Ternes, C.P. Lutz, B.A. Jones, and A.J. Heinrich at the IBM Almaden Research Center, San Jose, CA 95120 USA.