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Emerging magnetic stability in atomically assembled spin arrays
SEBASTIAN LOTH, Max Planck Research Group - Dynamics of Nanoelectronic Systems, Hamburg, Germany, SUSANNE BAUMANN, CHRISTOPHER P. LUTZ, D.M. EIGLER, ANDREAS J. HEINRICH, IBM Research - Almaden, San Jose, CA, USA — Magnetic stability is usually created by the interaction of a large ensemble of atomically small magnetic moments that are themselves unstable. We make use of the Scanning Tunneling Microscope's ability to move individual atoms and construct arrays of interacting spins. Owed to their smallness, the magnetic states of these spin arrays are quantized and we probe their energies by inelastic electron tunneling spectroscopy [1]. To gain access to the equally important dynamical properties we employ an all-electronic pump-probe measurement scheme with which we follow the evolution between the spin states at nanosecond speed [2]. The combination of energetic and dynamical information allows identification of the relevant spin interaction and spin relaxation mechanisms at the atomic level. We design arrangements of atoms that suppress quantum tunneling of magnetization and drastically stabilize different spin configurations. Tracing the emergence of magnetic stability in the progression from individual atoms to arrays of spins points to new avenues for spintronic applications at atomic dimensions.

[1] A. J. Heinrich, J. A. Gupta, C. P. Lutz, D. M. Eigler, Science 306 466 (2004).
[2] S. Loth, M. Etzkorn, C. P. Lutz, D. M. Eigler, A. J. Heinrich, Science 329 1628 (2010).

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