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Plasmons and Electrons as Nanosecond-Fast Sensors for Scanning Tunneling Microscopy SEBASTIAN LOTH, Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany — The ability to measure the fast dynamical evolution of atomic-scale systems often holds the key to their understanding. We combine fast pump-probe spectroscopy tools with low-temperature scanning tunneling microscopy to study atomically assembled arrays of magnetic atoms. The dynamical information quantifies spin lifetimes, magnetic stability and even allows identifying the cross-over between quantum spins and classical magnetism [1]. The spin relaxation times of transition metal atoms can be measured by all-electronic pump probe spectroscopy in which nanosecond-fast voltage pulses excite the spins and probe the average time-dependent response by variations in the spin-polarized tunnel current. In addition, the fast evolution of the local electrostatic potential can be mapped by detecting plasmonic light emission from the STM tunnel junction with time correlating single photon counting [2]. The combination of electrical stimulus and optical detection provides precise control of the excitation process of individual atoms enabling new experiments to probe charge and spin dynamics in the scanning tunneling microscope. [1] S. Loth, S. Baumann, C. P. Lutz, D. M. Eigler, A. J. Heinrich, Science 335, 196 (2012). [2] C. Grosse, M. Etzkorn, K. Kuhnke, S. Loth, K. Kern, Appl. Phys. Lett. 103, 183108 (2013).

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