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Tunneling through a single magnetic atom: spin-dependent elastic and inelastic processes C.F. HIRJIBEHEDIN, A. MODY, X. SHI, A. FISHER, London Centre for Nanotechnology, Dept. of Physics & Astronomy, Dept. of Chemistry, UCL, A.F. OTTE, NIST, M. TERNES, S. LOTH, C.P. LUTZ, A.J. HEINRICH, IBM Research Division, Almaden Research Center — Recent low-temperature scanning tunneling microscopy and spectroscopy studies have used inelastic electron tunneling to probe the spin excitations of magnetic atoms, molecules, and bulk surfaces. Here we describe the mechanisms that drive these spin excitations using a combination of resonant two-step and three-step virtual processes, with the latter including a simple exchange coupling between the tunneling electron and the electrons that comprise the atomic spin. Our description predicts the existence of a sum rule that includes a previously unnoticed type of spin-dependent elastic scattering, and evidence of both are seen in the observed spectra. We discuss the key factors that determine the relative strength of the inelastic tunneling, providing insight on when such processes can be observed and potentially how they might be enhanced.

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