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**Measuring exchange interactions between atomic spins using electron spin resonance STM** KAI YANG, WILLIAM PAUL, IBM Almaden Research Center, FABIAN NATTERER, EPFL, Switzerland, TAEYOUNG CHOI, IBM Almaden Research Center, ANDREAS HEINRICH, Ewha Womans University, South Korea, CHRISTOPHER LUTZ, IBM Almaden Research Center — Exchange interactions between neighboring atoms give rise to magnetic order in magnetic materials. As the size of the electronic device is miniaturized toward the limit of single atoms, magnetic nanostructures such as coupled atomic dimers and clusters are explored more as prototypes for possible data storage, spintronics as well as quantum computing applications. Characterizing inter-atom exchange interactions calls for increasing spatial resolution and higher energy sensitivity to better understand this fundamental interaction. Here, using spin-polarized scanning tunneling microscopy (STM), we studied a magnetically coupled atomic dimer consisting of two 3d transition metal atoms, with one adsorbed on an insulating layer (MgO) and the other attached to the STM tip. We demonstrate the ability to measure the short-range exchange interaction between the two atomic spins with orders-of-magnitude variation ranging from milli-eV all the way to micro-eV. This is realized by the successful combination of inelastic electron tunneling spectroscopy (IETS) and electron spin resonance (ESR) techniques in STM implemented at different energy scales. We unambiguously confirm the exponential decay behavior of the direct exchange interaction.

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