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Controlling Quantum Nanomagnets with Atomic Exchange Bias

SHICHAO YAN, DEUNG-JANG CHOI, JACOB BURGESS, STEFFEN ROLF-PISSARCZYK, SEBASTIAN LOTH, 1. Max Planck Institute for the Structure and Dynamics of Matter, 22761 Hamburg; 2. Max Planck Institute for Solid State Research, 70569 Stuttgart — Miniaturizing spintronic devices to the point where magnetization of the device's elements becomes quantized is a possible avenue to achieving quantum computation with magnetic elements. Critical to such an approach is the ability to exert local control over the quantum nanomagnets . Atomic exchange bias field has been proposed as a mechanism for localized control of individual nanomagnets. Here we demonstrate that exchange coupling with the magnetic tip of a scanning tunnelling microscope provides continuous tuning of spin dynamics in an individual nanomagnet. By directly measuring spin relaxation time with electronic pump-probe spectroscopy, we find that the exchange interaction acts analogously to a local magnetic field that can be applied to a specific atom. It can be tuned in strength up to several teslas and cancel external magnetic fields, thereby demonstrating the feasibility of complete control over individual quantum magnets with atomically localized exchange coupling.

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