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Realizing Spin Logic Atom by Atom[1]

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Scanning tunneling microscopy (STM) has emerged as a leading technique which can address single atom magnetism with high energy and spatial resolution. With the development of sub-Kelvin high-magnetic field STM, two complementary methods, namely spin-polarized scanning tunneling spectroscopy (SP-STS) and inelastic STS (ISTS), can address the fundamental properties of individual magnetic impurities at surfaces [1,2]. We use a map of the distance-dependent RKKY interaction between Fe atoms on Cu(111) obtained by SP-STS to engineer complex magnetic nanostructures with tailored magnetic properties with atomic manipulation. By combining constructed anti-ferromagnetic structures with spin frustration, we realize an atomic-scale logic device which functions solely on the spin-degrees of freedom of its magnetic constituents. This work was done in collaboration with J. Wiebe, S. Lounis, B. Chilian, A. T. Costa, L. Zhou, D. L. Mills, and R. Wiesendanger.

[1] A. A. Khajetoorians, B. Chilian, J. Wiebe, S. Schuwalow, F. Lechermann, and R. Wiesendanger, Nature 467, 1084 (2010).
[2] A. A. Khajetoorians, S. Lounis, B. Chilian, A. T. Costa, L. Zhou, D. Mills, J. Wiebe, and R. Wiesendanger, arXiv:1010.1284v2 (2010).

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