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Fabrication of nanoscale magnet-tipped cantilevers for magnetic resonance force microscopy STEVEN A. HICKMAN, Department of Chemistry and Chemical Biology, Cornell University, SEAN R. GARNER, Department of Physics, Cornell University, LEE E. HARRELL, Department of Physics, United States Military Academy, SEPPE KUEHN, JOHN A. MAROHN, Department of Chemistry and Chemical Biology, Cornell University — Magnetic resonance force microscopy(MRFM) is a promising new technique for acquiring magnetic resonance images of a single molecule; to date we have demonstrated a sensitivity of approximately 10,000 proton spins. In MRFM the force exerted on the cantilever, per spin, is proportional to the field gradient from the cantilever's magnetic tip. To increase the force requires shrinking the magnet size. Achieving the attonewton force sensitivity necessary to image single spins requires mitigating surface induced dissipation. We choose to meet both of these conditions by creating nanoscale magnets extending from the tips of silicon cantilevers. We will present a 50-nm wide overhanging cobalt magnet fabricated by a process involving electron beam lithography and anisotropic KOH etching. This process can be integrated into a fabrication protocol for ultrasensitive silicon cantilevers. With these cantilevers we expect a sensitivity of better than 1000 protons.

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