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Attonewton force detection near a surface SEPPE KUEHN[1], SEAN GARNER[2], JOHN MAROHN[3], 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 an unprecedented sensitivity of $\sim 10^5$proton spins. Moving forward requires that force microscopy enter a new regime, where attonewton (10^{-18} N) forces are measured near a surface. To facilitate this we operate custom fabricated, low spring constant, high quality factor cantilevers with their motion parallel to the sample surface. We observe that cantilever force sensitivity degrades with decreasing tip-sample separation due to energy losses. Our measurements indicate that this effect is dependent on tip size, composition, and tip-sample voltage. Theoretical models suggest that this effect might be due to dielectric fluctuations within the sample or inhomogeneous charge distributions on the surface. We have designed experiments to test these hypotheses and to elucidate the detailed mechanism of energy losses between a cantilever and a surface.

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