Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Non-degenerate parametric amplification used for surface noise evasion in scanned probe microscopy SANGGAP LEE, ERIC MOORE, STEVEN HICKMAN, Cornell University, LEE HARRELL, U.S. Military Academy, JOHN MAROHN, Cornell University — A straightforward way to enhance sensitivity and spatial resolution of magnetic resonance force microscopy is approaching an attonewton-sensitivity cantilever having a 100-nm diameter magnetic tip to closer than 50 nm proximity of spin samples. When one detects magnetic resonance via cantilever frequency-shift measurements, cantilevers experience a drastic increase of surface frequency noise at small tip-sample separations. Even along with lessening contribution of conducting tip charge to the noise, surface frequency noise remains as a remarkable obstacle. On the other hand, surface force noise was found to remain surprisingly unchanged up until about 10 nm with custom-fabricated overhanging magnetic nanorod tips. We thus developed a novel protocol, reading out a force-gradient (frequency-shift) spin signal as a force (amplitude change), harnessing spin-driven parametric amplification to evade surface noise and detector noise in force-gradient detected scanned probe magnetic resonance, presenting a demonstration on ESR from nitroxide spin probe in a thin film.

SangGap Lee
Cornell University

Date submitted: 20 Nov 2009 Electronic form version 1.4