Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Development of Low Temperature Nuclear Magnetic Resonance Force Microscopy (NMRFM) Experiments for Probing Nanoscale Films and Microcrystals JEREMY PASTER, DANIEL TENNANT, SHIRIN MOZAFFARI, JOHN MARKERT, The University of Texas at Austin — Force detection of nuclear spins is accomplished by coupling NMR spin-flip sequences to a mechanical oscillator. A thin ferromagnet deposited on the tip of the oscillator sets up a large gradient magnetic field in the vicinity of the spins. This provides a magnetic force signature which we can distinguish from the thermal noise of the oscillator. The gradient field also traces out a slice in space in which spins are resonantly tuned to the RF field. We review the advantages of various strategies for inducing nuclear spin flips including cantilever-driven and RF-modulation techniques. We also report on the current state of the project, highlighting important developments and experimental results. In particular, we've adapted a low temperature NMRFM probe for easy transition between thin-film and microcrystal experiments. In one configuration, we orient the oscillator perpendicular to the sample plane so we can work in the region where the ferromagnet's field gradient is largest. Conversely, we can rotate the oscillator 90 degrees to change the geometry of the gradient field. With this orientation we maximize resolution in one dimension by using the flat part of the resonance slice to pick up as many in-plane nuclei as we can.

Jeremy Paster
The University of Texas at Austin

Date submitted: 15 Nov 2013 Electronic form version 1.4