Abstract Submitted
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Optimal Control-Enabled Imaging and Spectroscopy using a Nanowire Magnetic Resonance Force Microscope[1] WILLIAM ROSE, University of Illinois at Urbana-Champaign, HOLGER HAAS, University of Waterloo, ANGELA CHEN, University of Illinois at Urbana-Champaign, DAVID CORY, University of Waterloo, RAFFI BUDAKIAN, University of Illinois at Urbana-Champaign, University of Waterloo — Magnetic resonance imaging (MRI) is a powerful non-invasive technique that has transformed our ability to study the structure and function of biological systems. Key to its success has been the unique ability to combine imaging with magnetic resonance spectroscopy. Although it remains a significant challenge, there is considerable interest in extending MRI spectroscopy to the nanometer scale because it would provide a fundamentally new route for determining the structure and function of complex biomolecules. We present data taken with a nanowire magnetic resonance force microscopy (MRFM) setup. We show how the capabilities of this very sensitive spin-detection system can be extended to include spectroscopy and nanometer-scale imaging by combining optimal control theory (OCT) techniques with magic echo sequences. We apply OCT-based dynamical-decoupling pulses to nanoscale ensembles of proton spins in polystyrene, and demonstrate a 500-fold line-narrowing of the proton spin resonance, from 30 kHz to 60 Hz. We further demonstrate 1-D imaging over a 35-nm region with an average voxel size of 2.2 nm.

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