

Abstract Submitted
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Measurement of statistical nuclear spin polarization in a nanoscale GaAs sample FEI XUE, DENNIS WEBER, PHANI PEDDIBHOTLA, MARTINO POGGIO, Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel, Switzerland — We measure the statistical polarization of quadrupolar nuclear spins in a sub-micrometer ($0.6 \mu\text{m}^3$) particle of GaAs using magnetic resonance force microscopy. The crystalline sample is cut out of a GaAs wafer and attached to a micro-mechanical cantilever force sensor using a focused ion beam technique. Nuclear magnetic resonance is demonstrated on ensembles containing less than 5×10^8 nuclear spins and occupying a volume of around $(300 \text{ nm})^3$ in GaAs with reduced volumes possible in future experiments. We discuss how the further reduction of this detection volume will bring the spin ensemble into a regime where random spin fluctuations, rather than Boltzmann polarization, dominate its dynamics. The detection of statistical polarization in GaAs therefore represents an important first step toward 3D magnetic resonance imaging of III-V materials on the nanometer-scale.

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