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Detection and Manipulation of the Statistical Fluctuations in Nuclear Spin Ensembles Using Magnetic Resonance Force Microscopy H.J. MAMIN, R. BUDAKIAN, B.W. CHUI, D. RUGAR, IBM Research Division, Almaden Research Center — We have detected and manipulated the naturally occurring $\sqrt{N}$ statistical polarization in nuclear spin ensembles using MRFM. We have studied fluorine nuclei in CaF_2, as well as protons in the polymer PMMA and the protein collagen. The ensembles studied contained of order 10^8 nuclear spins, corresponding to volumes of order $(200\text{nm})^3$, which resulted in statistical polarizations of order 10^4 net spins. We have also implemented a scheme similar to one proposed by Weitekamp *et al*, in which we suppressed the effect of the statistical uncertainty so as to extract meaningful information from time-averaged measurements. In this way, we have successfully made nutation and transverse spin relaxation measurements in a nominally unpolarized sample of CaF_2 at low temperatures.

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