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Experiments using Force Detected Nuclear Magnetic Resonance¹

HAN-JONG CHIA, ROSA E. CARDENAS, ISAAC MANZANERA ESTEVE, MARK C. MONTI, JOHN T. MARKERT, University of Texas at Austin — We describe experiments using force detected nuclear magnetic resonance (NMR). We have developed a helium-3 system for high sensitivity measurements. An initial room temperature scan on $(\text{NH}_4)_2\text{SO}_4$ demonstrated 1-D resolution of $10 \mu\text{m}$; a spin nutation experiment determined the value of the rotating magnetic field to be 13 gauss, and a spin echo was observed with a full width half maximum of $8 \mu\text{s}$. At 77 K we obtained the first force detected boron NMR signal in a $30 \mu\text{m}$ powder sample of the superconductor MgB_2 . Our measurements yielded a force of 10^{-13} N with $B_1 = 63$ gauss. Further studies are underway to map the spin lattice relaxation with respect to temperature to elucidate the pairing symmetry of MgB_2 as well as effects due to its two nearly independent electronic bands. In addition we describe the construction of a compact room temperature probe and a variable temperature probe for dynamical imaging experiments.

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