Intrinsic Gas-Phase Spin Relaxation of $^{129}$Xe

B.C. ANGER, M.S. SOLUM, R.J. PUGMIRE, B. SAAM, University of Utah — Hyperpolarized (HP) $^{129}$Xe produced through spin-exchange optical pumping (SEOP) techniques is useful for many NMR and MRI applications. At gas densities typical for SEOP, fluctuations in the spin-rotation and chemical shift anisotropy interactions mediated by the formation and breakup of loosely bound $^{129}$Xe-Xe molecules have recently been identified as the primary intrinsic spin relaxation mechanism, with $T_1$ limits as short as $\approx 5$ hours for samples of pure Xe. We have shown that this relaxation mechanism can be suppressed at high magnetic fields, leading to $T_1$ relaxation times of $\approx 100$ h at 14.1 T. Further results showed a near doubling of relaxation times with moderate temperature increases from 293 K to 393 K, implying a maximum intrinsic relaxation time of $\approx 9$ h at 393 K. In the field regime practical for SEOP (2.8 mT), we observed $^{129}$Xe relaxation times of nearly 5 hours in a 1 amagat Xe sample at 393 K. These results suggest a practical, low-field, non-cryogenic storage system that will provide Xe hold times much longer than those currently available from standard cryogenic storage systems on flow-through Xe polarizers.

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