Noble Gas Polarimetry Using Rb EPR Frequency Shifts

Z.L. MA, K. JEONG, E. HOUGHTBY, T. PASKVAN, M.E. LIMES, B. SAAM, University of Utah — EPR frequency shifts of optically polarized alkali-metal atoms can be exploited for polarimetry of noble-gas nuclei polarized by spin-exchange optical pumping. Our group recently measured the enhancement factor $\kappa_0 = 493$ for Rb-$^{129}$Xe [1], which characterizes the electron wave-function overlap during collisions and is crucial to the calibration of the frequency-shift for $^{129}$Xe polarimetry. This type of polarimetry is useful in several applications involving optically polarized $^{129}$Xe; our particular motivation is an in situ measurement of absolute $^{129}$Xe polarization within the optical pumping cell of a flow-through $^{129}$Xe polarizer [2]. This application has some particular challenges, and we have initially observed some unexpected shifts in the $^{87}$Rb EPR frequency measurement on board the polarizer. In effort to disentangle these apparent systematic effects, we have constructed a separate experiment to characterize Rb EPR shifts for both $^3$He and $^{129}$Xe in sealed cells. We present results and analysis of these experiments and discuss implications for using this method in flow-through polarizers.


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