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Spin-exchange narrowing in a nuclear magnetic transverse oscillator[1] ANNA KORVER, DANIEL THRASHER, MICHAEL BULATOWICZ, THAD WALKER, University of Wisconsin-Madison — We demonstrate spin exchange narrowing in synchronously pumped Xe NMR. The Xe NMR is driven by spin exchange with Rb atoms whose polarization is square-wave modulated at the Xe NMR frequency. On resonance, the nuclei precess in phase with the Rb polarization. Off resonance, however, the spin-exchange fields from the Rb cause the Xe to develop a static orthogonal spin component. This induces broadening in the NMR line while also dramatically suppressing the phase shift between the precessing Rb and Xe polarizations. We can compensate for this effect by adding an oscillating magnetic field oriented along the optical pumping axis and 180 degrees out of phase with the Rb polarization. This narrows the NMR line width to approximately the T1 limit, and nearly restores the usual relationship between detuning and phase shift. These results suggest the possibility of using the alkali field with appropriate magnetic field feedback along the bias field direction to narrow the NMR linewidth below the usual T1 limit.

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