Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Synchronous Spin Exchange Optical Pumping for Precision NMR
ANNA KORVER, JOSH WEBER, DANIEL THRASHER, THAD WALKER, University of Wisconsin-Madison — We present the successful execution of synchronous spin exchange optical pumping for precision NMR. In this novel form of NMR, the bias field is applied as a sequence of alkali 2π pulses; the resulting transverse alkali polarization is then modulated at the NMR frequency and spin exchange collisions build up a transverse precessing noble gas polarization. As compared to longitudinally pumped NMR, this method suppresses the alkali frequency shift by over a factor of 2500. We also discuss how we use synchronous spin exchange optical pumping to excite two noble gas species simultaneously. With dual species operation, we are able to use one species to lock the magnetic field while the other is left to detect nonmagnetic interactions. This method promises to achieve NMR frequency uncertainties of $100\text{nHz}/\sqrt{\text{Hz}}$. Research supported by the NSF and Northrop-Grumman Corp.

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Date submitted: 29 Jan 2016 Electronic form version 1.4