

Abstract Submitted  
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**Photon Budget in Spin Exchange Optical Pumping**<sup>1</sup> BRIAN LANCOR, ROBERT WYLLIE, THAD WALKER, University of Wisconsin-Madison — Standard models of spin-exchange optical pumping that include all known collisional spin relaxation and assume excited-state nuclear spin conservation consistently under-represent the amount of optical pumping light required to produce large quantities of polarized gas. The extremely large optical depths ( $\sim 100$ ) used in these experiments require high transparency for fully polarized alkali atoms. Should polarized atoms continue to absorb light, even at a small rate, the effects on photon usage are dramatic. We are currently investigating the frequency dependence of the circular dichroism of the Rb D1 resonance. This effect may be of particular importance for broad linewidth laser sources. In addition, we have quantitatively modeled the evolution of the Rb nuclear spin during the optical pumping process, and find that the standard assumption of nuclear spin conservation in the excited state is violated and has a significant effect on photon usage.

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