Abstract Submitted
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Precision measurement of the nuclear polarization of laser-cooled, optically pumped 37K[1] J.A. BEHR, I. CRAICIU, A. GORELOV, S. SMALE, C.L. WARNER, L. LAWRENCE, TRIUMF, B. FENKER, R.S. BEHLING, M. MEHLMAN, D. MELCONIAN, Texas AM U., G. GWINNER, M. ANHOLM, U. Manitoba, J. MCNEIL, U. British Columbia, D. ASHERY, I. COHEN, Tel Aviv U. — We have spin-polarized laser cooled ^{37}K by direct optical pumping and measured the polarization to $< 0.1\%$ accuracy [B. Fenker arXiv:1602.04526]. Our polarization method naturally monitors the polarization of the nuclei as they decay. The atoms absorb circularly polarized light directed along the quantization axis near-resonant with the atomic $S_{1/2}$ to $P_{1/2}$ transition. Once the atoms are polarized, they stop absorbing light, so the ratio between the final $P_{1/2}$ population and its initial maximum probes the degree of polarization. We monitor the $P_{1/2}$ population using UV photons energetic enough to photoionize the $P_{1/2}$ state but not the $S_{1/2}$ state. Since the final $P_{1/2}$ population nearly vanishes, 5% precision on the final/maximum ratio determines the polarization to 0.1%. We eliminate a nonclassical effect, coherent population trapping, which could produce poorly polarized unexcited atoms. We show planned upgrades. Our result for the nuclear vector polarization during our A_β measurement [B. Fenker, this conference] was 99.13(9)%, not the dominant systematic.

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