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Continuous Measurement of the 133 Cs Clock Transition Pseudospin SOUMA CHAUDHURY, GREG SMITH, KEVIN SCHULTZ, POUL JESSEN, University of Arizona — We demonstrate a weak continuous measurement of the pseudospin associated with the clock transition in a sample of laser cooled Cs atoms. Our scheme uses an optical probe tuned near the D1 transition to measure the sample birefringence, which is proportional to the population in one of the clock states and therefore provides information about the z component of the collective pseudospin. For proper probe polarization and frequency the differential light shift of the clock states vanishes and the measurement becomes non-demolition, at least on timescales short compared to optical pumping due to the scattering of probe photons. The measurement performance is comparable to that seen in Faraday measurements of spin-angular momenta, and is in excellent agreement with our theoretical models. In optically dense samples the measurement sensitivity can be high enough to allow backaction-induced squeezing, which suggests potential applications in the improvement of atomic clocks and atom interferometers.

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