Abstract Submitted
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**Conditional Spin Squeezing via Quantum Non-demolition Measurements with an Optical Cycling Transition**[1] JOSHUA WEINER, KEVIN COX, MATTHEW NORCIA, JUSTIN BOHNET, ZILONG CHEN, JAMES THOMPSON, JILA and University of Colorado at Boulder — We present experimental progress towards quantum non-demolition (QND) measurements of the collective pseudo-spin $J_z$ composed of the maximal $m_F$ hyperfine ground states of an ensemble of $\sim 10^5$ $^{87}$Rb atoms confined in a low finesse $F = 710$ optical cavity. Measuring the phase shift imposed by the atoms on a cavity probe field constitutes a QND measurement that can be used to prepare a conditionally spin squeezed state. By probing on a closed optical transition, we highly suppress both fundamental and technical noise due to Raman scattering compared to probing on an open transition. It may be possible to generate spin squeezed states with $> 10$ dB enhancement in quantum phase estimation relative to the standard quantum limit. The resulting spin squeezed states may specifically enable magnetic field sensing beyond the standard quantum limit as well as broadly impact atomic sensors and tests of fundamental physics.

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