

Abstract Submitted
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Conditional Spin-Squeezing of a Large Ensemble via the Vacuum Rabi Splitting¹ ZILONG CHEN, JUSTIN G. BOHNET, SHANNON R. SANKAR, JIAYAN (PHOENIX) DAI, JAMES K. THOMPSON, JILA, NIST, University of Colorado at Boulder — We demonstrate that the collective vacuum Rabi splitting can be used to perform quantum nondemolition (QND) measurements of the psuedo-spin projection J_z for the two-level clock states of nearly 10^6 ^{87}Rb atoms confined in a low finesse $F = 710(10)$ optical cavity. The QND measurement is used to prepare a conditionally spin-squeezed state. We infer a 3.4(6) dB improvement in quantum phase estimation relative to the standard quantum limit for a coherent spin state composed of uncorrelated atoms. The measurement is enhanced using a large ensemble and may lead to more precise atomic sensors and tests of fundamental physics.

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Zilong Chen
JILA and University of Colorado at Boulder

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