Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Deterministic Squeezed States with Joint Measurements and Feedback GRAHAM P. GREVE, KEVIN C. COX, BAOCHEN WU, JAMES K. THOMPSON, JILA, CU-Boulder, NIST — Joint measurement of many qubits or atoms is a powerful way to create entanglement forprecision measurement and quantum information science. However, the random quantum collapse resulting from the jointmeasurement also leads to randomnessin *which* entangled state is created. We present an experiment in which we applyreal-time feedback to eliminate the randomness generated during the joint measurement of 5×10^4 laser-cooled Rbatoms. The feedback effectively steers the quantum state to a desired squeezed state. After feedback, the final state achieves a directly observed phase resolution variance up to 7.4(6) dBbelow the standard quantum limit for unentangled atoms. The entanglement and improved measurement capability of these states can berealized without retaining knowledge of the joint measurements outcome, possibly opening new applications for spin squeezed states generated via joint measurement.

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Date submitted: 24 Feb 2016

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