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Collective state measurement of mesoscopic ensembles with single-atom resolution HAO ZHANG, ROBERT MCCONNELL, Massachusetts Institute of Technology, SENKA CUK, University of Belgrade, QIAN LIN, MONIKA SCHLEIER-SMITH, IAN LEROUX, VLADAN VULETIC, Massachusetts Institute of Technology — For mesoscopic ensembles containing 100 or more atoms we measure the total atom number and the number of atoms in a specific hyperfine state with single-atom resolution. The measurement detects an atom-induced frequency shift of an optical cavity containing the ensemble. This work extends the range of cavity-based detection with single-atom resolution by more than an order of magnitude in atom number, and provides the readout capability necessary for Heisenberg-limited atom interferometry.

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