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Quantum State Magnification NILS ENGELSEN, ONUR HOSTEN, RAJIV KRISHNAKUMAR, MARK KASEVICH, Stanford University — The standard quantum limit (SQL) for quantum metrology has been surpassed by as much as a factor of 100 using entangled states. However, in order to utilize these states, highly engineered, low-noise state readout is required. Here we present a new method to bypass this requirement in a wide variety of physical systems. We implement the protocol experimentally in a system using the clock states of 5×10^5 ^{87}Rb atoms. Through a nonlinear, optical cavity-mediated interaction we generate spin squeezed states. A small microwave rotation followed by an additional optical cavity interaction stage allow us to exploit the full sensitivity of the squeezed states with a fluorescence detection system. Though the technical noise floor of our fluorescence detection is 15dB above the SQL, we show metrology at 8dB below the SQL. This is the first time squeezed states prepared in a cavity are read out by fluorescence imaging. The method described can be used in any system with a suitable nonlinear interaction.

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