Abstract Submitted
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Ultrasensitive atomic spin measurements with a nonlinear interferometer[1] ROBERT J. SEWELL, ICFO - Institute of Photonic Sciences, MARIO NAPOLITANO, Department of Physics and Astronomy, Aarhus University, NAEIMEH BEHBOOD, GIORGIO COLANGELO, FERRAN MARTIN CURIANA, MORGAN W. MITCHELL, ICFO - Institute of Photonic Sciences — We study nonlinear interferometry applied to a measurement of atomic spin and demonstrate a sensitivity that cannot be achieved by any linear-optical measurement with the same experimental resources. We use alignment-to-orientation conversion, a nonlinear-optical technique from optical magnetometry, to perform a nondestructive measurement of the spin alignment of a cold Rb-87 atomic ensemble. We observe state-of-the-art spin sensitivity in a single-pass measurement, in good agreement with covariance-matrix theory. Taking the degree of measurement-induced spin squeezing as a figure of merit, we find that the nonlinear technique's experimental performance surpasses the theoretical performance of any linear-optical measurement on the same system, including optimization of probe strength and tuning. The results confirm the central prediction of nonlinear metrology, that superior scaling can lead to superior absolute sensitivity. Reference: Sewell, et al. Phys. Rev. X 4, 021045 (2014)

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