Abstract Submitted
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Magnetometric sensitivity optimization for nonlinear optical rotation with frequency-modulated light LOUIS RENE JACOME, SRIKANTH GUTTIKONDA, LOK FAI CHAN, ERIC J. BAHR, DEREK F. JACKSON KIMBALL, California State University - East Bay — Coherence between ground-state Zeeman sublevels of alkali atoms can survive thousands of collisions with paraffin-coated cell walls. The resulting long coherence times achieved in evacuated, paraffin-coated cells enable precise measurement of energy shifts of ground-state Zeeman sublevels. In the present work, nonlinear magneto-optical rotation with frequency-modulated light (FM NMOR) is used to measure ground-state Zeeman shifts for rubidium atoms contained in a paraffin-coated cell. A systematic optimization of the magnetometric sensitivity of FM NMOR as a function of light power, detuning, frequency-modulation amplitude, and rubidium vapor density is carried out for the rubidium D1 and D2 lines. For a 5-cm diameter cell at temperature T = 25^oC, the optimal potential shot-noise-limited magnetometric sensitivity is found to be 80 pG/$\text{Hz}^{1/2}$ (corresponding to a sensitivity to Zeeman shifts of 40 μHz/$\text{Hz}^{1/2}$ or 10^{-19} eV/$\text{Hz}^{1/2}$). Application of these techniques to a new search for a long-range spin-mass coupling will be discussed.

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