Abstract Submitted
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Rotation Sensing with a Trapped Barium Ion[1] RANDY PUTNAM, ADAM WEST, WES CAMPBELL, PAUL HAMILTON, University of California, Los Angeles — We present progress toward a trapped ion gyroscope [1]. We perform Ramsey interferometry between Zeeman states of a $^{138}Ba^{+}$ ion using a modified version of the spin-dependent kicks technique [2]. Rotation of the apparatus at rate Ω during the interferometer sequence produces a Sagnac phase: $\Phi = \frac{4\pi E}{hc^2}(N\vec{A}) \cdot \vec{\Omega}$, with $E = mc^2$ the particle energy and $N\vec{A}$ the interferometer's effective area. Ions provide a 10^{11} increase in particle energy compared to photons and together with the ability for ions to orbit many times (N) in the trap, we will reach sensitivities comparable to commercially available gyros ~ 1 μrad $s^{-1}Hz^{-1/2}$. A recent study of systematics shows the feasibility of the technique [3]. We show ultrafast coherent control of a Zeeman qubit using a 36 W mode-locked Nd:YAG laser with 76 MHz rep rate, performing both Rabi and Ramsey experiments using two orthogonal Raman beams which allows us to impart momentum on the ion. We are currently working towards free-oscillation interferometry.
[1] W. C. Campbell and P. Hamilton, J. Phys. B. 50, 064002 (2017)
[2] J. Mizrahi et al., Phys. Rev. Lett. 110, 203001 (2013)
[3] A. West, Phys. Rev. A 100, 063622 (2019)

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