Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Rotation Sensing with a Trapped Barium Ion[1] RANDY PUTNAM, ADAM WEST, WES CAMPBELL, PAUL HAMILTON, California State University, Los Angeles — We present progress toward an experiment using a Zeeman qubit and a modified version of the recently developed spin-dependent kicks technique [1] to create an interferometric matter-wave gyroscope with a single $^{138}Ba^+$ ion in a linear Paul trap [2]. A rotation rate, Ω can be extracted by measuring the Sagnac phase: $\Phi = \frac{4\pi E}{hc^2}(N\vec{A}) \cdot \vec{\Omega}$, where E is the particle energy, and $N\vec{A}$ is the effective area of the interferometer. In order to reach sensitivities comparable to commercially available gyroscopes ($\sim 1\mu$rad s^{-1}Hz$^{-1/2}$) we take advantage of the increased energy afforded by using massive particles and allowing the ion to orbit in the trap N times before closing the interferometer. With the ion's long coherence time and a secular trap frequency of 10–100 kHz we hope to achieve $N = 100$ orbits in the trap. We have trapped and shown coherent control of a Zeeman qubit using a mode-locked Nd:YAG laser. This includes observing both Rabi oscillations and Ramsey fringes using a Raman transition between the qubit states.

Reference:

[1] J. Mizrahi et al., Phys. Rev. Lett. 110, 203001 (2013)
[2] W. C. Campbell and P. Hamilton, J. Phys. B. 50, 064002 (2017)

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Date submitted: 06 Feb 2019 Electronic form version 1.4