Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Matter-wave soliton based rotation sensing YOGESH PATIL, HIL FUNG HARRY CHEUNG, Cornell University, SUNIL BHAVE, Purdue University, MUKUND VENGALATTORE, Cornell University — Atom interferometers can in principle achieve rotation sensitivities much better than the best current optical gyroscopes. However, the practical realization of compact, trapped-atom rotation sensors have been limited by significant technical and fundamental constraints. We propose and evaluate an integrated platform for Sagnac interferometry using matter-wave solitons generated and confined in a quasi-1-dimensional evanescent wave optical dipole trap around a microtoroidal resonator. Numerical simulations based on the truncated Wigner approximation (TWA) show that the non-dispersive nature of solitons allows us to substantially increase the effective area enclosed by the Sagnac interferometer arms – enabling a projected shot-noise limited phase sensitivity of 10 mrad/$\sqrt{\text{Hz}}$ and a rotation sensitivity below 8 x 10^{-7} rad/s/$\sqrt{\text{Hz}}$. We also discuss prospects of using the intrinsic interactions within the soliton as a means of obtaining spin-squeezing and enhanced interferometric contrast.

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Date submitted: 01 Feb 2019

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