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Sagnac Interferometry with Bose-Einstein Condensates in a Uniformly Rotating Ring Trap[1] MARTY KANDES, Computational Science Research Center, San Diego State University, San Diego, California 92182-1245, MICHAEL BROMLEY, Centre for Quantum-Atom Optics, School of Mathematics and Physics, The University of Queensland, Brisbane QLD 4075, Australia —
We present the results of numerical simulations studying a novel scheme to perform Sagnac interferometry with Bose-Einstein condensates in a uniformly rotating ring trap. The proposed scheme involves determining the relative phase shifts between two counter-propagating condensate wavepackets as the angular velocity of the ring trap is varied. Analyzing the interference patterns obtained from the simulations, we find that, for the most part, the phase shift response closely follows that predicted by the Sagnac effect, even when the nonlinear mean-field interaction of the condensate is large. However, we unexpectedly find that the linear accumulation of the relative phase shift with respect to time manifests itself as step-like phase jumps during collisions of the wavepackets, with the magnitude of the phase jumps being linearly dependent upon the angular velocity of the rotating ring trap and the angular momenta of the wavepackets. We provide details of the proposed scheme and discuss some of the advantages this unexpected behavior in the phase shift response may offer in performing Sagnac interferometry with Bose-Einstein condensates in the future.

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