Abstract Submitted
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Fast Quantum Control of Trapped ^{87}Rb Bose-Einstein Condensates[1] DENUWAN VITHANAGE, SKYLER WRIGHT, E. CARLO SAMSON, Miami University — We present numerical simulations on manipulating Bose-Einstein condensates (BECs) at a fast rate while maintaining the coherence properties of its initial quantum state. The main problem in transporting a quantum system like a BEC at a fast rate is that the energy we add to the system for transport will change the BEC's initial state or completely destroy the BEC. Two-dimensional (2D) simulations of BEC transport are performed by numerically solving the Gross-Pitaevskii equation (GPE) using a split-step Fourier method. In our simulations, we use trapping potentials in the form of painted potentials because it is possible to achieve arbitrary, dynamic traps with this method. In order to achieve high quantum fidelity, we use shortcuts-to-adiabaticity (STA) for high-speed BEC transport. With these simulations, we compared different time intervals for a particular spatial displacement that a BEC can travel while keeping high quantum fidelity using experimentally feasible parameters. The effects of atomic interactions, and trapping frequencies to the effectiveness of STA will also be discussed.

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