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Trajectory Simulation and Optimization for Shortcuts to Adiabaticity using Artificial Neural Network HOK WAI CHANG, JOHN FEMIANI, E. CARLO SAMSON, Miami University — Adiabatic transportation for a sensitive quantum system such as Bose-Einstein Condensate (BEC) has implications to quantum control and quantum computing, and transporting a BEC in anharmonic traps is still a difficult issue to approach mathematically. Therefore, we developed a computational method to optimize the transportation trajectory. We first created an Artificial Neural Network (ANN) to simulate the transportation of a BEC by inputting the trajectory into the ANN and let the ANN predicts the behavior of the transportation. Then we apply the ANN as an objective function of the BFGS optimization algorithm and using it to obtain the optimal trajectory. Compare to using Gross-Pitaevski equation (GPE) to compute the behavior of the transportation as the objective function, using ANN can substantially decrease the optimization time since computing a pre-trained ANN is much simpler than computing each step of the trajectory using GPE. This research shows the ability to use ANN to simulate a series of GPE calculations and gives preliminary results on the trajectory for adiabatic transportation of BECs in anharmonic traps.

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