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Temporal Auto-Correlation Function Pushed to One Pixel Limit

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Quantum transport in a neutral atom guide provides intriguing quantum effects that are important aspects in designing atom mechatronic structures such as quantum interferometer, pump, valve, and amplifier structures. We investigate applicability of spatial reduction in temporal auto-correlation function to reduce computational resources in finding eigen-energy inside the guide. We find that we can reduce the size of the correlation function to an area 65,536 times smaller than the entire simulation space (0.0015%), which corresponds to an area of one pixel. The maximum error of all energies is 8.18% for a ground state and the trend of errors reduces exponentially as the principle quantum number increases. The setting of the investigation involves initial Gaussian wave packet evolving in a 2D harmonic potential and the correlation space is concentric to the center of the initial wave packet.

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