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Quantum pumping with ultracold atoms M. IVORY, College of William and Mary, K. DAS, Kutztown University, T. BYRD, College of William and Mary, K. MITCHELL, University of California Merced, J. DELOS, S. AUBIN, College of William and Mary — Quantum pumping is a mechanism for generating a very precise, bias-less flow of electrons between two reservoirs by applying a local pumping potential. However, previous quantum pumping experiments have been unsuccessful due to competing capacitive coupling and rectification effects in solid state systems. Ultracold atoms offer the possibility of bypassing these difficulties and testing previously unverified theoretical predictions. We present numerical simulations to identify experimental parameters which are capable of yielding large currents using time-varying pumping schemes. Our simulations are both quantum and classical in nature and explore double barrier and double well turnstile pumps with rectangular and Gaussian potentials. We show that for a specific momentum classes, there is significant pumping. Also, due to multiple reflections between the barriers in the classical case, some particles show significant dependence upon initial conditions suggestive of fractal behavior. We present preliminary theoretical results for various schemes and suggest parameters for ultracold atom experiments.

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