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Development of an atomic quantum pump: Bose-Einstein condensate scattering from an oscillating barrier MEGAN IVORY, A.J. PYLE, TOMMY BYRD, College of William and Mary, KEVIN MITCHELL, University of California at Merced, JOHN DELOS, College of William and Mary, KUNAL DAS, Kutztown University, SETH AUBIN, College of William and Mary — Quantum pumping is a proposed method for generating precise electron transport in mesoscopic systems without applying an external voltage bias. Instead, localized time-varying potentials are used to pump an electron current through a circuit. Quantum pumps offer the prospect of generating highly controlled and reversible currents at the single electron level. Unfortunately, progress towards the experimental realization of such a mechanism in regular conductors has been difficult due to spurious capacitive coupling and rectification effects. As an alternative, we are investigating the use of neutral ultracold atoms instead of electrons to simulate quantum pumping. In addition to avoiding electromagnetic interactions, our ultracold atoms display a high degree of coherence, allowing us to study the quantum aspects of pumping in addition to the classical aspects. As a first step toward implementing a double barrier turnstile pump, we focus on observing and studying scattering of a Bose-Einstein condensate (BEC) from a single oscillating barrier potential. We have recently developed the theory for this type of scattering in classical, semi-classical, and quantum frameworks. We present video simulations of the scattering processes as well as progress towards testing this framework experimentally with a BEC of ^{87}Rb.

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