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Topological Analysis of an Atomic Quantum Pumping System¹ TOMMY BYRD, Department of Physics, College of William and Mary, Williamsburg, VA 23187, USA, KEVIN MITCHELL, School of Natural Sciences, University of California, Merced, CA 95344, USA, JOHN DELOS, Department of Physics, College of William and Mary, Williamsburg, VA 23187, USA — We examine a system consisting of two reservoirs of particles connected by a channel. In the channel are two oscillating repulsive potential-energy barriers. It is now known that such a system can transport particles from one reservoir to the other, even when the chemical potentials in the reservoirs are equal. We use computations and the theory of chaotic transport – an iterated map of the phase plane – to study this system. Transport is described by passage around or through a heteroclinic tangle. Topological properties of the tangle are described using a generalization of Homotopic Lobe Dynamics (HLD). This theory uses a symbolic algebra to characterize topological properties of the tangle, and predicts some properties of high iterates of the map (long-time behavior) from properties of low iterates (short-time behavior). We compare these predicted properties with direct computation of trajectories. We find that HLD accurately predicts all transport properties forced by the initial topological structure of the tangle. In addition, we also find transport properties not predicted by the initial topology.

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