Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Competing Adiabatic Thouless Pumps in Enlarged Parameter Spaces POUYAN GHAEMI, City College of New York, PEDRO LEOPOLDO E SILVA LOPES, Universite de Sherbroke, SHINSEI RYU, TAYLOR L. HUGHES, University of Illinois at Urbana Champaign — The transfer of conserved charges through insulating matter via smooth deformations of the Hamiltonian is known as quantum adiabatic, or Thouless, pumping. Central to this phenomenon are Hamiltonians whose insulating gap is controlled by a multi-dimensional (usually two-dimensional) parameter space in which paths can be defined for adiabatic changes in the Hamiltonian, i.e., without closing the gap. Here, we extend the concept of Thouless pumps of band insulators by considering a larger, three-dimensional parameter space. We show that the connectivity of this parameter space is crucial for defining quantum pumps, demonstrating that, as opposed to the conventional two-dimensional case, pumped quantities depend not only on the initial and final points of Hamiltonian evolution but also on the class of the chosen path and preserved symmetries. We distinguish the scenarios of closed/open paths of Hamiltonian evolution, finding that different closed cycles can lead to the pumping of different quantum numbers, and that different open paths may point to distinct scenarios for surface physics.

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Date submitted: 22 Feb 2017 Electronic form version 1.4