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Dynamically symmetry breaking in a bipartite optical lattice

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Profile

Ian B. Spielman is a Fellow of the Joint Quantum Institute (JQI), a joint research institute between the National Institute of Standards and Technology (NIST) and the University of Maryland (UMd). A member of the NIST technical staff since 2006, in 2014 Spielman was appointed as a ï¿½NIST Fellowï¿½ (of NIST's 1,800 member technical staff, just 40 are IST fellows). Spielman is an experimentalist in atomic, molecular and optical physics but was trained as a condensed matter physicist during his Ph.D. at Caltech from 1998 to 2 04. Spielman's research centers using ultracold-atom systems - just 10's of nano-Kelvin a ove absolute zero - to realize many-body phenomena so common in conventional material as well as analogues to high energy and cosmological physics. He has pioneered technique to add artificial magnetic fields and spin-orbit coupling to cold-atom systems opening the oor for new many-body systems. Spielman has received many awards on account of this rese rch including the 2015 APS I.I. Rabi Prize in Atomic, Molecular, and Optical Phys

Abstract

Topological invariants robustly classify gapped quantum systems in equilibrium, and phenomena such as the quantized Hall effect---the progenitor of the von Klitzing constant---are macroscopic reflections of these invariants.

In addition to dimensionality, the presence or absence of symmetries determines the possible topological invariants. Thus, these invariants remain constant provided that no gaps close and no symmetries are added or removed. For this reason, one might expect the topology of a dynamical quantum system to be similarly robust; this expectation is untrue. Instead as a system undergoes far from equilibrium evolution symmetries come and go, allowing the topology to change as well. We experimentally study these dynamics with ultracold atoms in a 1D bipartite lattice in terms of the Zak phase and a chiral winding number.

Hosted by: Prof. Dr. Leticia Tarruell