

# Berry Dipole-Driven Topological Phenomena in Acoustic Systems: From Oriented Landau Levels to Returning Thouless Pumps

*The University of Hong Kong, China*

**Shuang Zhang**

**Email: shuzhang@hku.hk**

Berry dipoles, paired singularities with opposite topological charges in momentum space, enable unique topological phenomena in physical systems. This talk presents two experimental studies harnessing these dipoles in carefully engineered acoustic systems. First, we demonstrate unconventional oriented Landau levels in acoustic Berry dipole systems, where reversing the pseudomagnetic field orientation yields distinct Landau spectra and reveals novel helical zero modes, whose existence depends on the field's orientation, unlike chiral zero modes in Weyl systems. This opens avenues for exploring gauge field interactions with band singularities beyond Chern-class, such as Berry multipoles. Second, we report realization of a Berry-dipole-mediated returning Thouless pump in a 1D acoustic waveguide array. By adiabatically encircling a Berry dipole singularity, an edge-localized pseudospin-down mode delocalizes into the bulk and returns to the original edge as a pseudospin-up mode, achieving spin conversion without net displacement, in contrast to monopole-based pumps. These findings offer new insights into topological acoustic devices and Berry curvature engineering.

## **Short Bio:**



## **Short Bio:**

**Shuang Zhang** is a chair Professor and interim Head of the Department of Physics at the University of Hong Kong. He obtained his PhD in Electrical Engineering from the University of New Mexico. Thereafter he worked as postdoc at UIUC and UC Berkeley. He joined the University of Birmingham, UK as a Reader in 2010 and was promoted to professor in 2013. Prof. Zhang joined the University of Hong Kong as a Chair Professor in 2020. He

---

was the recipient of IUPAP award in Optics (2010), ERC consolidator grant (2015-2020), Royal Society Wolfson Research Award (2016-2021), and New Cornerstone Investigator program (2023-2028). He was elected OSA fellow in 2016, APS fellow in 2022, and has been on the list of highly cited researchers (by Clarivate) since 2018.