# 北京大学量子材料科学中心

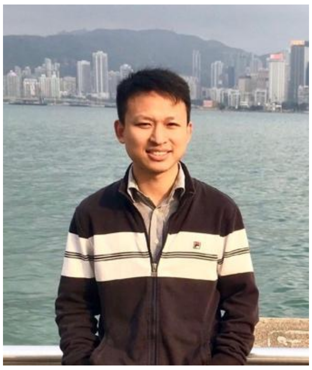
## International Center for Quantum Materials, PKU

## Weekly Seminar

# Chiral phonons in solid-state materials


徐远锋

*浙江大学*

**Time: 3:00 pm, May 13, 2026 (Wednesday)**

**时间：2026年5月13日（周三）下午3:00**

**Venue: Room w563, Physics building, Peking University**

**地点：北京大学物理楼，西563会议室**

## Abstract


Chiral phonons—circularly polarized lattice vibrations carrying intrinsic angular momentum—have emerged as a frontier in quantum materials science, with transformative implications for nonreciprocal thermal transport and quantum information processing. Recent experimental advances have shown that chiral phonons can give rise to a variety of intriguing quantum phenomena and effects, including the Einstein–de Haas effect, phonon magnetization, the phonon Hall effect, and orbital/spin Seebeck effects, while also providing a novel route for manipulating electronic states. In this work [1], we present a symmetry-based framework for systematically classifying chiral phonons across all crystallographic space groups. Rooted in symmetry representations of phonon angular momentum in reciprocal space, our theory reveals three distinct classes of phononic materials: achiral crystals with vanishing angular momentum, chiral crystals exhibiting conventional s-wave helicity, and a previously overlooked class of achiral crystals displaying exotic higher-order helicity patterns, including d-, g-, and i-wave helicities. We further derive the complete symmetry-constrained forms of the velocity–angular-momentum tensors that govern phonon magnetization in thermal transport for each class. Through high-throughput computational screening of 11,614 crystalline compounds, we identify 2,738 materials exhibiting chiral phonon modes and shortlist 170 of the most promising candidates for experimental investigation. We also numerically characterized the cycloidicity and magnetic moment of chiral phonons. These results are compiled into an open-access Chiral Phonon Materials Database website, *https://materialsfingerprint.com*, enabling rapid screening for materials with desired chiral phonon properties. Finally, I will present our recent progress on the thermal transport of chiral phonons [2] and discuss future directions in this rapidly developing field.



[1] Y. Yang et al, Nature Physics (2026)
[2] Y. Mao et al, in preparation


## About the speaker

徐远锋，浙江大学百人计划研究员、博士生导师。2019年博士毕业于中国科学院物理研究所，随后在德国马克斯•普朗克研究所和美国普林斯顿大学从事博士后研究。2022年加入浙江大学物理学院、关联物质研究中心。主要从事凝聚态理论与材料计算，研究兴趣包括固体中的拓扑与量子几何现象，以及关联电子体系中的演生物态。