



Special Seminar

Nonreciprocal Phonons in PT-Symmetric Antiferromagnets

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Time: 3:00 pm, July.8, 2025 (Tuesday)

时间: 2025年7月8日 (周二) 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

Phonon nonreciprocity, indicating different transport properties along opposite directions, has been observed in experiments under a magnetic field. We show that nonreciprocal acoustic phonons can also exist without a magnetic field or net magnetization. We identify crucial contributions in phenomenological elastic theory, In PT symmetric antiferromagnets, we find two terms, dubbed flexo viscosity and flexo torque, that induce phonon nonreciprocity. The microscopic origin of these terms is attributed to the derivatives of molecular Berry curvature, manifested as emergent nonlocal magnetic fields on phonons. The symmetry breaking that originated from spin order is transferred to the phonon system through spin-orbit coupling, where the orbital degree of freedom affects the lattice dynamics directly. By electrically breaking inversion symmetry and modifying the spin-orbit coupling, we find extra contributions and show that both the phonon nonreciprocity and helicity can be controlled and enhanced. Importantly, the phonon nonreciprocity is an odd function of the Néel vector, serving as an indicator of the order parameter.

About the speaker

牛谦, 中国科学技术大学杰出讲席教授。1981年毕业于北京大学, 1985年获美国华盛顿大学博士学位。1985-1990年分别在伊利诺伊大学和加州大学圣巴巴拉分校做博士后研究。1990年加入美国德克萨斯大学奥斯汀分校, 2001年任Trull Centennial讲席教授、2019年任Sid w. Richardson Foundation Regents讲席教授。2021年起任中国科学技术大学杰出讲席教授。主要研究方向为量子输运、Berry相、自旋霍尔效应、光晶格中的超冷原子、半导体的自旋电子学等。已发表SCI论文290余篇, 其中Science 3篇, Nature及子刊7篇, Physical Review Letters 85篇, Review of Modern Physical、Physics Today、Physics World各1篇。论文被引用超过33,000次, H指数为83。1999年当选为美国物理学会会士。