Seminar

Phase Diagram and Spectroscopic Signatures of Supersolids in Quantum Ising Magnet $K_2Co(SeO_3)_2$

Tong Chen
Johns Hopkins University

Time: 10:00 am, Feb.18, 2025 (Tuesday)

时间：2025年2月18日（周二）上午10:00

腾讯会议链接：https://meeting.tencent.com/dm/4y2WVnYp3vLb

腾讯会议ID：677-446-091

Abstract

A supersolid is a quantum-entangled state of matter that exhibits the dual characteristics of superfluidity and solidity. While theoretical studies have predicted that hard-core bosons with repulsive interactions on a triangular lattice can host a supersolid phase, experimental validation has remained elusive. Leveraging an exact mapping between bosons and spins, we investigate the supersolid phase in a spin-1/2 triangular-lattice antiferromagnet $K_2Co(SeO_3)_2$. Here, we present the magnetic phase diagram and neutron scattering results for $K_2Co(SeO_3)_2$, which features nearest-neighbor Ising-like interactions with J_z = 2.96(2) meV and $J_\perp$ = 0.21(3) meV. In zero field, neutron spectroscopy reveals the gradual development of a quasi-two-dimensional √3 × √3 magnetic order with Z3 translational symmetry breaking (solidity) below 15 K. At temperatures below 0.3 K, the fully developed supersolid phase is evidenced by the coexistence of a gapless Goldstone mode arising from broken U(1) spin rotational symmetry (superfluidity), and a gapped pseudo-Goldstone mode associated with lifted accidental XY degeneracy (solidity). In c-axis-oriented magnetic fields 1.1 T < B < 21 T, a prominent 1/3 magnetization plateau phase emerges, accompanied by a plausible high-field supersolid phase (17 T < B < 21 T). Our results establish $K_2Co(SeO_3)_2$ as an exceptional realization of a spin-1/2 triangular-lattice quantum Ising magnet, document its magnetic phase diagram featuring two supersolid phases, and uncover spectroscopic signatures of zero-field supersolidity in a triangular lattice antiferromagnet.

About the speaker

陈童博士是Johns Hopkins University （约翰霍普金斯大学）物理与天文学系的博士后，专注于实验凝聚态物理研究。他主要利用中子散射探测量子材料中的新奇物理现象，研究方向包括量子自旋体系、非常规超导体、磁拓扑材料和平带系统。陈博士2016年毕业于复旦大学物理系，并于2021年获Rice University（赖斯大学）物理学博士学位，师从Pengcheng Dai （戴鹏程）教授。