



Weekly Seminar

Unconventional Kondo and Josephson Effects in 1T-PtSe₂

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Time: 3:00 pm, March 18, 2026 (Wednesday)

时间: 2026年3月18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

The interplay between the Josephson effect, magnetic degrees of freedom, and the Kondo effect has been intensely studied, leading to promising applications such as the Andreev spin qubit. While research has largely focused on quantum-dot systems, Josephson junctions containing an ensemble of free magnetic moments remain underexplored—primarily because these moments tend to form long-range magnetic orders or undergo Kondo screening. In 1T-PtSe₂ nanoflakes, we find an unconventional Kondo effect manifested in its magnetotransport as well as a confinement-reduced Kondo temperature. Josephson junctions with PtSe₂ as the weak link exhibit multistability in their switching and retrapping currents, consistent with our theoretical model of multiple independent, free magnetic moments. This stochasticity persists up to 450 mK in temperature and in in-plane magnetic fields exceeding 0.1 T. By linking the critical current of a Josephson junction to local magnetic configurations, our work opens a new avenue for integrating atomic-defect spins into superconducting circuits for next-generation hybrid quantum platforms.

About the speaker

Hechen Ren is a Chair Professor in the Department of Physics at Tianjin University. She earned her B.A. from Columbia University and her Ph.D. from Harvard University, followed by an IQIM Postdoctoral Fellowship at the California Institute of Technology. Her research focuses on exploring exotic superconducting phenomena through low-temperature measurements of mesoscopic quantum devices. She is particularly interested in realizing topological superconductivity and developing next-generation hardware for quantum information and technology. She is best known for her pioneering studies on topological superconductivity in planar Josephson junctions, specifically utilizing the Josephson phase as a primary control.