



Seminar

Theoretical Explorations of Correlated Topological Phases

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International Center for Quantum Materials, Peking University

Time: 15:00pm, Jun.11 2026 (Thursday)

时间: 2026年6月11日 (周四) 下午15:00pm

Venue: Room w563, Physics Building, Peking University

地点: 北京大学物理楼, 西563会议室



Abstract

My research explores correlated topological phases in quantum materials, focusing on how topology, symmetry, disorder, and interactions generate new electronic states. I will summarize several representative directions from my tenure-track period. I developed the topological heavy fermion framework for magic-angle twisted bilayer graphene, providing a unified description of localized and itinerant topological degrees of freedom and a basis for understanding correlated insulating behavior, Kondo physics, and unconventional superconductivity. I also proposed an anti-Hund's coupling mechanism for superconducting pairing in this system. Beyond moiré materials, I established a finite and complete classification of spin space groups, offering a symmetry framework for unconventional magnetic orders and their electronic topology. I also studied disordered topological phases, including intrinsic statistical topological insulators and Anderson critical metallic phases protected by average symmetries, showing that disorder can create topological phases with no clean-limit counterpart. Finally, I will discuss critical topological flat bands as an emerging direction, where topology, flatness, and critical wave functions combine to enable new correlated states.

About the speaker

Zhi-Da Song received his Ph.D. in theoretical physics from the Institute of Physics, Chinese Academy of Sciences, in 2018. He then conducted postdoctoral research at Princeton University, and joined the International Center for Quantum Materials at Peking University in late 2021 as an Assistant Professor. His representative contributions include the complete classification and high-throughput computation of topological insulators in space groups, the proposal of the topological heavy fermion model, and the classification of spin space groups. He has published over 80 papers in leading journals including Physical Review Letters, Physical Review X, Nature, and Science, with more than 12000 citations and an H-index of 48. Recently, he was selected as a Clarivate Highly Cited Researcher.