清华大学高等研究院

Institute for Advanced Study, Tsinghua University

物理学术报告
Physics Seminars (biweekly)

Title: **Unconventional superconductivity: from electron-hole asymmetry in cuprates to charge-4e superconductivity**

Speaker: **Zi-Xiang Li**
Chinese Academy of Sciences (IOP CAS)

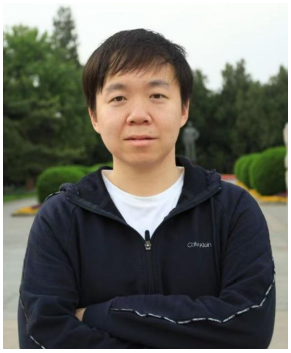
Time: **4:00 pm, Wednesday, April 1, 2026**

Venue: **Conference Hall 322, Science Building, Tsinghua University**

Abstract

This talk presents numerical insights into two distinct frontiers of unconventional superconductivity. First, we investigate the electron-hole asymmetry of antiferromagnetism in cuprates. We benchmark the antiferromagnetic response for a large range of dopings with various state-of-the-art numerical approaches. Across methods and accessible sizes/temperatures, we find no significant electron-hole asymmetry. We propose that dopant-induced disorder is a possible essential ingredient responsible for the asymmetry widely observed in experiments of cuprates; Second, I will discuss the emergence of charge-4e superconductivity in a doped SU(4) Su-Schrieffer-Heeger interaction model. Through sign-problem-free quantum Monte Carlo simulations, we show that while weak coupling yields conventional charge-2e pairing, strong interactions stabilize a primary charge-4e superconducting phase. Remarkably, the transition temperature of this exotic charge-4e state increases nearly linearly with interaction strength, realizing a robust, high-Tc charge-4e superconductor in the strong-coupling regime.

Bio



Zi-Xiang Li is an associate professor at the Institute of Physics, Chinese Academy of Sciences (IOP CAS). He received his B.S. degree from Beihang University in 2012 and his Ph.D. from the Institute for Advanced Study at Tsinghua University in 2017, under the supervision of Prof. Hong Yao. From 2017 to 2021, he conducted postdoctoral research at the UC Berkeley and Lawrence Berkeley National Laboratory, working with Prof. Dung-Hai Lee. He joined IOP CAS in June 2021. His research focuses on the theory and numerical computation of strongly correlated systems.