复旦大学物理系 Colloquium

Time: 14:00, Tuesday, 2023.9.12

Location: C108, Jiangwan Physics Building

Orbital superfluidity: from condensed matter to cold atoms

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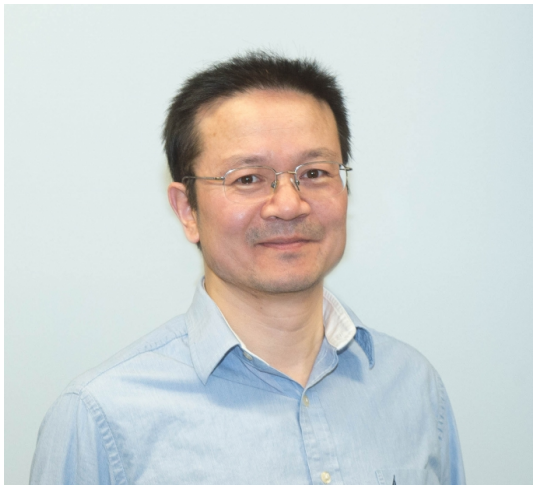
Abstract: Superfluidity and superconductivity have been an ever-inspiring topic that extends impact across physics subdisciplines from condensed matter through cold atom physics to high energy-density QCD matter. Orbital is a fascinating degree of freedom independent of charge and spin. It is known to play a rudimentary role in understanding the nature of superfluid pairings, such as s-, p-, and d-wave. In condensed matter, through its coupling to spin and charge, orbital order intertwines superconductivity, magnetism, and other quantum phenomena. The advanced spatiotemporal control of cold atoms provides new opportunities to explore orbital physics beyond standard quantum regimes, complementary to studies in condensed matter. In this talk, I will report on theoretical and experimental progress in orbital superfluidity, highlighting unique phases of matter emerging from the interplay of novel spatial lattice geometry and emerging orbital symmetries in artificial quantum simulators for fundamental physics.



Biography: Dr. Liu received his Ph.D. from the University of Texas at Austin in 1999 mentored by Professor Steven Weinberg. After graduation, he became a postdoctoral research associate at the University of Illinois at Urbana-Champaign under the guidance of Eduardo Fradkin and Mike Stone and then as a postdoctoral fellow at Massachusetts Institute of Technology mentored by Frank Wilczek, Patrick Lee and Xiao-Gang Wen. He has been on the faculty of the University of Pittsburgh since 2004 and serves as the founding director of Interdisciplinary Quantum Science for Fundamental Physics Initiative (IQ Initiative) in U of Pittsburgh starting 2022. He was the recipient of Outstanding Dissertation award from the Department of Physics in UT Austin in 1999, Outstanding Young Researcher Award from the International Organization of Chinese Physicists and Astronomers (OCPA) in 2007, and was elected Fellow of the American Physical Society in 2017. He was invited as General Member of Kavli Institute for Theoretical Physics in UC Santa Barbara in 2010-2011 and served in the National Advisory Board of KITPC/ITP of Chinese Academy of Sciences in Beijing (2011-16). He was elected to the presidential line of OCPA as Society Secretary (2021-23), VP (2023-25) and then President (2025-27).