## **JITCP Seminar**

THE UNIVERSITY OF HONG KONG HKU-UCAS JOINT INSTITUTE OF THEORETICAL AND COMPUTATIONAL PHYSICS

[Wednesday Afternoon, 3:30 pm, In Person]

## Quantum geometry in multi-orbital superfluidity and the pair density-wave state

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The discovery of quantum geometry in the superfluid weight calculation of 2D multi-orbital superconductors [1] has arisen great interest in this gauge-invariant quantity in interacting physics. As a positive semidefinite tensor, it ensures that the superconducting free energy is minimized by the BCS state, whose Cooper pairs have zero center-of-mass momentum. Our recent studies [2] show that the quantum geometry is only a special type of gauge-invariant quantities coming from the "uniform pairing channel". When going beyond this channel, the geometric superfluid weight is still gauge-invariant, but may not be positive semidefinite, therefore a pair density-wave state, a superconducting state whose electrons pair with finite center-ofmass momentum can be formed.

[1] Peotta, S., & Törmä, P. (2015). Superfluidity in topologically nontrivial flat bands. *Nature communications*, *6*(1), 8944.

[2] Jiang, G., & Barlas, Y. (2023). Pair density waves from local band geometry. *Physical Review Letters*, 131(1), 016002.

In Person Seminar Wednesday, August 9, 2023, 3:30 pm Room 522, 5/F, Chong Yuet Ming Physics Building, HKU

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