Quantum geometry in superconductors

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Abstract:
While the dispersion relation in the band structure is a fundamental property of electron systems in solids, quantum geometry in the band structure is essential for various many-body states and unconventional responses in quantum materials. In particular, the real part of the quantum geometric tensor, namely the quantum metric, recently attracts attention, although the imaginary part is well known as the Berry curvature. Studies of quantum geometry in superconductors were triggered by the discovery of quantum geometric correction to the superfluid weight in flat band systems [1], such as the Lieb lattice and twisted bilayer graphene. In the talk, I discuss the following topics of the quantum geometry in superconductors. (1) Enhancement of the BKT transition temperature in monolayer FeSe by quantum geometry [2]. (2) Unusual phase diagram of FFLO superconductivity [3]. (3) Finite-momentum pairing state in a spin-triplet superconductor UTe_2, named anapole superconductivity [4], and superconducting piezoelectric/diode effect [5]. (4) Spin-triplet superconductivity induced by quantum-geometry-induced ferromagnetic fluctuation [6].

References:
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