凝縮系物理学ゼミナール
Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 11 May 2022

Title: Quantum geometric effect on Flude-Ferrell-Larkin-Ovchinnikov superconductivity

Speaker: Taisei Kitamura (Condensed Matter Theory Group)

Abstract:

Quantum geometry characterizes the geometric properties of Bloch electrons in the wave space. For superconductors, the quantum geometry is recently clarified to appear in the superfluid weight [1]. Although the superfluid weight had been considered to be determined by the Fermi-liquid theory for a long time, the geometric contribution is nonnegligible in some superconductors, such as flat-band systems [2,3] and monolayer FeSe [4]. While the superfluid weight is essential for many superconducting phenomena related to the center of mass momenta of Cooper pairs (CMMCP), the quantum geometric effect on such phenomena is unrevealed.

In this seminar, we show the quantum geometric effect on the Fulde−Ferrell−Larkin−Ovchinnikov (FFLO) state acquiring a finite CMMCP in equilibrium. The phase diagram of an effective model for the monolayer FeSe with an in-plane magnetic field is calculated. In the case of the isotropic s-wave pairing, the quantum geometry stabilizes the BCS state. The quantum geometry induces the metastable BCS state the phase transition from the FFLO to the BCS state. On the other hand, for the inter-sublattice pairing, the quantum geometry has a negative contribution to the superfluid weight; quantum-geometry-induced FFLO superconductivity is realized.

Reference:

[1] S. Peotta and P. Törmä, Nat. Commun. **6**, 8944 (2015).
[2] A. Julku, et. al., Phys. Rev. Lett. **123**, 237002 (2016).
[3] A. Julku, et. al., Phys. Rev. B **117**, 045303 (2020).
[4] T. Kitamura, et. al., arXiv:2108.10008 (2021).