

凝縮系物理学ゼミナール

Condensed Matter Seminar

Date: 13:30-15:00, Wednesday, 6 October 2021

Title: Anapole superconductivity from PT-symmetric mixed-parity interband pairing

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Abstract:

Superconductivity with spontaneous time-reversal or parity symmetry breaking is recently attracting much attention owing to its exotic properties, such as nontrivial topology and nonreciprocal transport. Particularly fascinating phenomena are expected when the time-reversal and parity symmetry are simultaneously broken by the spontaneous ordering of PT-symmetric mixed-parity (e.g., s+ip-wave) superconductivity, which can be realized when the even- and odd-parity pairing instabilities are competing in one system [1].

In this seminar, we show that the PT-symmetric mixed-parity superconducting states generally exhibit an unusual asymmetric energy spectrum of Bogoliubov quasiparticles [2]. The origin of the asymmetry is identified as a nonunitary interband pairing. For generic two-band models, we derive the necessary conditions for the asymmetric Bogoliubov spectrum. We also demonstrate that the asymmetric Bogoliubov quasiparticles lead to the effective anapole moment of the superconducting state, which stabilizes the FFLO-like nonuniform state at zero magnetic fields. Our conclusions are relevant for any multiband superconductors with competing even- and odd-parity pairing interactions. Especially, we apply our theory to UTe₂, in which spontaneous ordering of mixed-parity superconductivity is recently proposed under pressure [3].

Reference:

- [1] Y. Wang and L. Fu, Phys. Rev. Lett. 119, 187003 (2017).
- [2] S. Kanasugi and Y. Yanase, arXiv:2107.07096 (2021).
- [3] J. Ishizuka and Y. Yanase, Phys. Rev. B 103, 094504 (2021).