凝縮系物理学ゼミナール

Condensed Matter Seminar

Location: **Room 413**, School of Science Bldg. 5 (理学 5 号館 413 号室)

Date: **13:30-15:00**, Wednesday, 24 October 2018

“Stabilization of vortex-liquid state by strong attractive interaction between electrons”

Speaker:

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Abstract:

The superfluid transition with variable attractive interaction between Fermions has been studied in the field of ultracold atomic physics [1]. Physical properties have been investigated especially in the BCS-BEC crossover regime, where the interaction between particles is strong enough to create non-condensed preformed pairs.

Intriguingly, recent experiments have suggested that a strong attractive interaction can exist in FeSe and related superconductors [2, 3, 4, 5], which can pave the way for material realization of the BCS-BEC crossover. In contrast to electrically neutral ultracold atoms, electrons in a superconductor are charged and thus naturally coupled with external magnetic field. Therefore, FeSe and related materials can provide an opportunity to experimentally elucidate unexplored magnetic-field effects on superconductors with strong attractive interaction. However, a theoretical understanding of magnetic-field effects on superconductors with strong attractive interaction is still lacking.

In this study, we theoretically investigate qualitative features of the field-temperature phase diagram of superconductors with strong attractive interaction. Starting with a simple attractive Hubbard model, we apply the T-matrix approximation and also analyze the Ginzburg-Landau action. Based on our numerical results, we conclude that a strong attractive interaction between electrons can stabilize both the vortex-liquid and the preformed-pair states.

References:

[1] M. Randeria and E. Taylor, Annu. Rev. Condens. Matter Phys. 5, 209 (2014).

[2] S. Kasahara et al., Proc. Nat. Acad. Sci. USA 111, 16309 (2014).

[3] S. Kasahara et al., Nat. Commun. 7, 12843 (2016).

[4] A. Shi et al., J. Phys. Soc. Jpn. 87, 013704 (2017).
[5] S. Rinott et al., Sci. Adv. 3, e1602372 (2017).