

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, 13 December 2017

“BCS-BEC crossover in quasi-two-dimensional system”

Speaker:

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Abstract:

FeSe, one of the iron-based superconductors, has some unusual features. First, the superconducting gap Δ and critical temperature T_c are comparable to the effective Fermi energy E_F [1]. This indicates that the standard BCS theory, which assumes $\Delta \ll E_F$, is not applicable to FeSe. Second, the magnetization measurement around T_c has shown that the diamagnetic response is about ten times larger than that within the weak-coupling approximation [2]. These features suggest an intriguing possibility that superconductivity in FeSe emerges in the strong-coupling BCS-BEC crossover regime.

As another feature of FeSe, quasi-two dimensionality due to the layered structure is focused on in this study. We investigate the effect of quasi-two dimensionality on the BCS-BEC crossover physics by taking into account a shift in chemical potential [3]. As a result, we figure out that the BCS-BEC crossover can occur when the dimensionality is lowered from three to two. In this talk, I will explain the result and propose some experimental setup to realize the dimensionality-driven BCS-BEC crossover.

References:

[1] S. Kasahara *et al.*, Proc. Natl. Acad. Sci. USA **111**, 16309 (2014).

[2] S. Kasahara *et al.*, Nat. Commun. **7**, 12843 (2016);

K. Adachi and R. Ikeda, Phys. Rev. B **96**, 184507 (2017).

[3] P. Nozières and S. Schmitt-Rink, J. Low Temp. Phys. **59**, 195 (1985).