

# 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: 13:00-14:00, Wednesday, 19 November 2014

### Fermi surface evolution and $d$ -wave superconductivity in CeCoIn<sub>5</sub>

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#### Abstract:

Ce115 compounds are particularly suited to detailed studies of the interplay between antiferromagnetic (AF) quantum criticality and unconventional superconductivity due to their high sample quality and their chemical and physical tenability [1,2]. Although it is widely believed that their superconductivity is a  $d$ -wave one mediated by the AF spin fluctuation in experiments [3], microscopic understanding of the pairing mechanism and the pairing gap features remains to be unveiled.

In the present study, based on the advanced first-principles theoretical approach, we investigate the superconducting gap structure and the pairing glue in CeCoIn<sub>5</sub> system [4]. Unexpectedly, the nesting property in the original GGA-based band structure, which is considered to be consistent with the dHvA measurement, shows a  $Q$  structure incompatible with the observations. Instead we find the importance of the temperature dependent Fermi surface evolution driven by electron correlations, which has been calculated by the DMFT method. Considering this effect, we obtain reasonable AF correlation, which can also induce the expected  $d$ -wave superconductivity.

#### Reference:

- [1] H. Shishido *et al.*, J. Phys. Soc. Jpn. **71**, 162 (2002).
- [2] J. D. Thompson and Z. Fisk, J. Phys. Soc. Jpn. **81**, 011002 (2012).
- [3] M. P. Allan *et al.*, Nature Phys. **9**, 468 (2013).
- [4] T. Nomoto and H. Ikeda, Phys. Rev. B **90**, 125147 (2014).