

# 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, 22 January 2014

### “Angular dependence of high-field low-temperature (HFLT) superconducting phase”

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Abstract:

The heavy-fermion superconductor CeCoIn<sub>5</sub> has attracted much attention due to its HFLT phase, where the spatially modulated Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) vortex lattice state is thought to be realized [1]. Intriguingly, in a magnetic field parallel to the *a-b* plane, neutron scattering measurements have revealed the existence of the incommensurate AFM order in almost the same region as the HFLT phase [2]. To try to understand the origin of this AFM order, several mechanisms have been proposed. We have proposed that AFM order is induced by the strong Pauli-paramagnetic pair-breaking (PPB) effect in  $d_{x^2-y^2}$ -wave superconductor and stabilized by a FFLO modulation [3].

Recent a NMR measurement has clarified that with tilting the field from the *a-b* plane, the AFM ordered region is pushed down to lower fields and pure (nonmagnetic) FFLO phase appears just below H<sub>c2</sub>. In addition, the NMR data in tilted fields has clarified the sharp rise of H<sub>c2</sub> line in low-temperature region [4].

In this talk, we will present a theoretical discussion on the angular dependence of the HFLT phase. We will demonstrate that the appearance of pure FFLO state observed in the NMR measurement is due to the incomplete nesting condition [5]. We will also discuss on the rise of H<sub>c2</sub> observed in the NMR measurement.

References:

[1] H. Adachi and R. Ikeda, Phys. Rev. B **68**, 184510 (2003).

[2] M. Kenzelman et. al., Science. **321**, 1652 (2008).

[3] Y. Hatakeyama and R. Ikeda, Phys. Rev. B **83**, 224518 (2011).

[4] K. Kumagai, presented in M<sup>2</sup>S

[5] K. Hosoya and R. Ikeda, Phys. Rev. B **88**, 094513 (2013).