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, 19 December 2012

“Angular dependence of antiferromagnetic order in high-field superconducting phase”

Speaker: Mr. **Kenichi Hosoya** (Condensed Matter theory Group)
Abstract: The heavy-fermion superconductor $CeCoIn_5$ has attracted much attention due to its high-field low-temperature (HFLT) phase associated with the spatially modulated Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) vortex lattice state [1]. The identification of this HFLT phase as FFLO state is supported by a NMR measurement [2] and others.

On the other hand, in a magnetic field parallel to the *ab*-plane, neutron scattering measurements have revealed the existence of the incommensurate AFM order in almost the same region as the HFLT phase [3]. Usually the AFM order and SC order are intriguingly competitive. 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_{x2-y2}-wave superconductor and stabilized by a FFLO modulation [4].

Another neutron scattering experiment has shown that this AFM order disappears within the 17° tilting of the applied field out of the *ab*-plane [5], while the FFLO order survives up to 20° rotation. To provide further insight on the angular dependence of the HFLT phase, we develop our theory and examined the angular dependence of the AFM structure. It is demonstrated that, with tilting the field from the *ab*-plane, the AFM ordered region is pushed down to lower temperatures and lower fields to terminate an AFM QCP at a slightly lower field than $H_{c2}(0)$, and that the resulting AFM order is out-of-phase from the FFLO order in contrast to the high field behavior in fields parallel to the *ab*-plane. This result has been supported by a recent NMR measurement [6].

References:

[1] H. Adachi and R. Ikeda, Phys. Rev. B **68**, 184510 (2003).
[2] K. Kumagai et al., Phys. Rev. Lett. **106**, 137004 (2011).
[3] M. Kenzelman et. al., Science. **321**, 1652 (2008) .
[4] Y. Hatakeyama and R. Ikeda, Phys. Rev. B **83**, 224518 (2011).
[5] E. Blackburn et. al., Phys. Rev. Lett. **105**, 187001 (2010).
[6] K. Kumagai et. al.: unpublished.