

# 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: 13:30-14:15, Wednesday, 20 November 2013

### Effect of magnetic criticality and Fermi-surface topology on magnetic penetration depth

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#### Abstract:

Recently, a sharp peak of the zero-temperature penetration depth has been observed in  $\text{BaFe}_2(\text{As}_{1-x}\text{P}_x)_2$  at anti-ferromagnetic quantum critical point[1]. Such a tendency of increase toward AF phase boundary has been also reported in a heavy-fermion compound  $\text{CeCoIn}_5$ . In addition, concerning the temperature dependence, remarkable deviation from the expected  $T$ -linear behavior at low temperatures, rather  $T^{1.5}$  dependence has been reported in these line-nodal superconductors, as well as organic compounds [2,3].

We investigate the effect of AF quantum criticality on the magnetic penetration depth in unconventional superconductors[4]. The critical magnetic fluctuation renormalizes both the mass and the current vertex, and enhances zero-temperature penetration depth drastically, which is more remarkable in the iron-pnictides case due to the Fermi-surface topology. Additional temperature dependence of the current renormalization makes the expected  $T$ -linear behavior of the penetration depth approach  $T^{1.5}$  asymptotically in line-nodal superconductors.

#### Reference:

- [1] K. Hashimoto *et al.*, *Science* **336**, 1554 (2012).
- [2] A. Carrington *et al.*, *Phys. Rev. Lett.* **83**, 4172 (1999).
- [3] K. Hashimoto *et al.*, *Proc. Natl. Acad. Sci. USA* **110**, 3293 (2013).
- [4] T. Nomoto and H. Ikeda, *Phys. Rev. Lett.* **111**, 167001 (2013).