

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)

Time and date: 13:30 – 15:00, Wednesday, 29 May 2013

Kondo effect and magnetic order in f-electron superlattices

Speaker: Dr. Robert Peters

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Abstract:

Recently, remarkable experiments at Kyoto university on f-electron systems have opened a new research field. They created for the first time in the world superlattices consisting of f-electron materials [1,2,3]. This enabled them to create novel f-electron materials with intriguing properties, which can be tuned by changing the structure of the superlattice. For example, when the Cerium-layer thickness in CeIn₃/LaIn₃- superlattice is reduced, also the Neel temperature of the antiferromagnetic order decreases, two-dimensional quantum fluctuations are increased, and signs of quantum criticality like derivations from Fermi-liquid theory can be observed.

In f-electron materials, the competition between the Kondo effect and the RKKY interaction is the driving force for many of the intriguing properties, such as quantum criticality, non-Fermi-liquid behavior and unconventional superconductivity. In this talk, I will theoretically analyze these fundamental mechanisms, i.e. the Kondo effect and the RKKY interaction, in the context of f-electron superlattices. For example, it is important to note that the Kondo effect in these superlattices does not only affect the f-electron layers, but also influences the normal-metal layers. The Kondo effect in the normal-metal layers shows a interesting interference property depending on the structure of the superlattice. Furthermore, I will study magnetism induced by the RKKY interaction. In this regard, I will especially focus on how different f-electron layers are coupled to each other.

References:

- [1] H. Shishido, T. Shibauchi, K. Yasu, T. Kato, H. Kontani, T. Terashima, and Y. Matsuda; *Science* **327**, 980 (2010).
- [2] Y. Mizukami, H. Shishido, T. Shibauchi, M. Shimozawa, S. Yasumoto, D. Watanabe, M. Yamashita, H. Ikeda, T. Terashima, H. Kontani, and Y. Matsuda; *Nat. Phys.* **7**, 849 (2012).
- [3] K. Goh, Y. Mizukami, H. Shishido, D. Watanabe, S. Yasumoto, M. Shimozawa, M. Yamashita, T. Terashima, Y. Yanase, T. Shibauchi, A. I. Buzdin, and Y. Matsuda; *Phys. Rev. Lett.* **109**, 157006 (2012).