

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: **15:45-17:15**, Wednesday, 2 December 2015

“Anomalous Kondo effect and topological phase transitions in Ultracold alkaline-earth fermions”

Speaker:

Masaya Nakagawa (Condensed Matter Theory Group)

Abstract:

Kondo effect appears universally in condensed matter, such as magnetic impurities in metals, various rare-earth compounds, and mesoscopic quantum dot devices. Apart from solid state systems, it has been proposed that this effect can be also realized in ultracold atomic gases [1-3]. Extending the possibilities of the Kondo effect in various systems is fascinating because it provides not only an experimental platform but also fresh insights into the Kondo physics, which is a typical manifestation of the strong correlation.

In this talk, we investigate some peculiar properties of the Kondo effect based on our recent proposal to realize the Kondo lattice model using ultracold atoms [4]. In this setup, two long-lived (meta-)stable electronic states of alkaline-earth atoms are used as "orbitals", and the Kondo effect is induced by optical transitions between these orbitals. Since the polarization of the optical field couples with the spin degrees of freedom, the optically-induced Kondo effect has unusual spin states different from the well-known Kondo singlet. We show that the anomalous Kondo state is certainly distinct from the Kondo singlet state, protected by some symmetry. Furthermore, we demonstrate that the optically-induced Kondo effect leads to a topological phase transition from a Haldane-like phase to the anomalous Kondo state, when we focus on a one-dimensional version of this system.

References:

[1] A. V. Gorshkov *et al.*, Nat. Phys. **6**, 289 (2010).

[2] J. Bauer *et al.*, Phys. Rev. Lett. **111**, 215304 (2013).

[3] Y. Nishida, Phys. Rev. Lett. **111**, 135301 (2013).

[4] M. Nakagawa and N. Kawakami, Phys. Rev. Lett. **115**, 165303 (2015).