

第 534 回物性セミナー・  
創発的物性物理研究拠点セミナー

**Electronic structure of  $\text{EuTGe}_3$  ( $T$ : transition metal) studied  
by x-ray spectroscopies**

講師 Yuki Utsumi Boucher 氏

(Institute of Physics, 46 Bijenička, 10000 Zagreb, Croatia)

日時 2018 年 12 月 21 日 (金) 10:00-

場所 理学研究科 C212

\*This seminar talk will be given in English.

Quantum critical phase transitions have been one of the central issues in strongly correlated 4f-electron systems. At absolute zero temperature, tuning non-thermal control parameters, such as pressure and magnetic field, tilts the balance between the competing ground states associated with conflicting Kondo effects and Ruderman-Kittel-Kasuya-Yoshida interactions [1]. The competition between Kondo and RKKY interactions in Ce- and Yb-compounds are often discussed using the Doniach phase diagram [2], whereas Eu compounds are believed to have a first-order phase transition with a Eu valence transition and not to have a quantum critical point (QCP). Most of the reported Eu-compounds favor divalent electronic states ( $\text{Eu}^{2+}$ ,  $J=7/2$ ) with an antiferromagnetic ground state. By applying pressure or a small element substitution, the system undergoes a first-order phase transition by changing into a non-magnetic ground state with a trivalent (or valence fluctuating) state ( $\text{Eu}^{3+}$ ,  $J=0$ ). Very recently, an unconventional behavior has been discovered in antiferromagnetic  $\text{EuRhSi}_3$  and  $\text{Eu}_2\text{Ni}_3\text{Ge}_5$  [3] and indicates a potential QCP.

$\text{EuTGe}_3$  ( $T= \text{Co, Ni, Rh, Ir}$ ) and  $\text{EuRhSi}_3$  are isostructural, possessing a non-centrosymmetric  $\text{BaNiSn}_3$ -type crystal structure. The Eu ions expect to be in a divalent electronic state and antiferromagnetic ordering appears at  $\sim 10\text{-}15\text{ K}$  [4]. We have performed hard x-ray photoelectron spectroscopy [5] and partial fluorescence yield x-ray absorption spectroscopy on  $\text{EuTGe}_3$ . Details of the changes in the electronic structure as a function of transition metal substitution and pressure will be discussed in the talk.

References

- [1] Q. Si, *et al.*, *Science* **329**, 1161-1166 (2010).
- [2] S. Doniach, *Physica B* **91**, 231 (1977).
- [3] A. Nakamura, *et al.*, *J. Phys. Soc. Jpn* **84**, 053701 (2015); S. E. Muthu, *et al.*, *J. Phys. Soc. Jpn*. **85**, 094603 (2016); M. Nakashima, *et al.*, *J. Phys. Soc. Jpn*. **86**, 034708 (2017).
- [4] O. Bednarchuk, *et al.*, *J. Alloys Comp.* **622**, 432-439 (2015).
- [5] Y. Utsumi, *et al.*, *Phys. Rev. B* **97**, 115155 (2018).

5 研究科共同セミナーの認定科目です

担当：木村 昭夫（理学研究科）



【世話人】  
高根 美武 (内 7653) 浴野 稔一 (内 6552)  
松村 武 (内 7021) 木村 昭夫 (内 7471)  
犬丸 啓 (内 7741)  
【広報担当】  
稲垣 (内 5720)

