

# Dynamical valence fluctuations in $\text{YbAlB}_4$ observed by $^{174}\text{Yb}$ SR-based Mössbauer Spectroscopy

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Synchrotron-radiation-(SR)-based  $^{174}\text{Yb}$  Mössbauer spectroscopy is new state-of-the-art technique to investigate electronic states of Yb ions in compounds. The energy resolution of this technique is much higher than that of the conventional Yb Mössbauer spectroscopies. Valence fluctuating compounds  $\text{YbAlB}_4$  have two crystal structures,  $\alpha\text{-YbAlB}_4$  ( $Pbam$ ) and  $\beta\text{-YbAlB}_4$  ( $Cmmm$ ). These form in the orthorhombic layered Yb, Al layers and B layers in turn and Yb ions have one crystallographic site. Although  $\alpha\text{-YbAlB}_4$  is a heavy fermion compound behaved like Fermi-liquid below  $T^* \sim 8$  K,  $\beta\text{-YbAlB}_4$  exhibits anomalous quantum criticalities without tuning. We have applied this new technique to investigate electronic states of Yb ions in  $\beta\text{-YbAlB}_4$  at low temperatures.

The SR-based  $^{174}\text{Yb}$  Mössbauer experiments were performed using the single-crystalline samples of  $\beta\text{-YbAlB}_4$  at ambient pressure and under pressure up to  $\sim 3$  GPa on BL09XU and BL19LXU at SPring-8. We observed two absorption components related to the  $\text{Yb}^{2+}$  and  $\text{Yb}^{3+}$  ions in the  $^{174}\text{Yb}$  SR-based Mössbauer spectra of  $\beta\text{-YbAlB}_4$  below 5 K. This characteristic feature in the spectra disappears above  $\sim T^*$  and then almost one absorption component was observed in the spectra. The widths of the absorption components are much wider than that expected in the present experimental conditions. We evaluated the averaged relaxation time of the Yb ions between the  $\text{Yb}^{2+}$  and  $\text{Yb}^{3+}$  ionic states via the analyses of  $^{174}\text{Yb}$  SR-based Mössbauer spectra using a stochastic model. It is clarified that this refined relaxation time correlates closely with non-Fermi liquid behaviors observed in  $\beta\text{-YbAlB}_4$ .

In the presentation, I will show the pressure dependence of  $^{174}\text{Yb}$  Mössbauer spectra of  $\beta\text{-YbAlB}_4$  at 2 K and discuss the dynamics of valence fluctuation of Yb ions in  $\beta\text{-YbAlB}_4$ .