Magnetic excitations in Weyl–Kondo semimetal $Nd_3Co_4Sn_{13}$

K. Iwasa[A], S. Asai[B], H. Kikuchi[B], T. Masuda[B]

[A] *Research and Education Center for Atomic Sciences, Ibaraki Univ.*, [B] *ISSP-NSL, Univ. of Tokyo*

The $Ln_3Tr_4Sn_{13}$ (Ln = rare earth elements and Tr = transition metal elements) class of materials show various electronic states [1]. $Ce_3Tr_4Sn_{13}$ (Tr = Co, Rh, and Ir) were initially proposed to be heavy fermion systems. Recently, the low-temperature crystal structure of these Ce-based compounds were found to be chiral (noncentrosymmetric), represented by the $I2_13$ space group [2]. The low-temperature symmetry supports an asymmetric spin–orbital effect, which provides topological Dirac/Weyl fermions. Consequently, $Ce_3Rh_4Sn_{13}$ was evidenced to be a Weyl–Kondo semimetal, in which the Kondo hybridized band exhibits a linear function of momentum [3]. The Weyl electrons contribute to anomalous magnetic interactions. In present study, we attempted to detect magnetic fluctuation in the Weyl–Kondo semimetal state of $Ce_3Rh_4Sn_{13}$.

Inelastic neutron scattering (INS) experiments for the coaligned single-crystal samples of $Ce_3Rh_4Sn_{13}$ synthesized using the molten Sn-flux method were performed using the cold-neutron multiplex triple-axis-spectrometer HODACA at HER (C1-1) [4]. The final neutron energy of 3.63 meV was chosen by the multiplex PG analyzers. Sample temperature was controlled using a ^{3}He cryostat.

Figure 1 shows INS spectra measured at the scattering vector $\boldsymbol{Q}$ = (–0.85, –0.85, ζ) of $Ce_3Rh_4Sn_{13}$ at 0.7 K (black circles) and 13 K (red squares). The data measured at the energy transfer E = 0.5 meV, shown in the upper panel, do not show any significant difference between 0.7 and 13 K. The lower panel shows the data measured at E = 0.25 meV. The intensity at 0.7 K is larger than that measured at 13 K. The signal enhancement is a characteristic behavior of the topological fermions because the Weyl–Kondo semimetal behavior dominates below approximately 1 K, as elucidated in the T^3 term of specific heat for the topological linear band [3]. Therefore, the characteristic magnetic fluctuation appears below 0.5 meV. However, no clear dependence on the momentum transfer was detected. At present, it is unclear how magnetic correlation emerges with the Weyl fermions in $Ce_3Rh_4Sn_{13}$.

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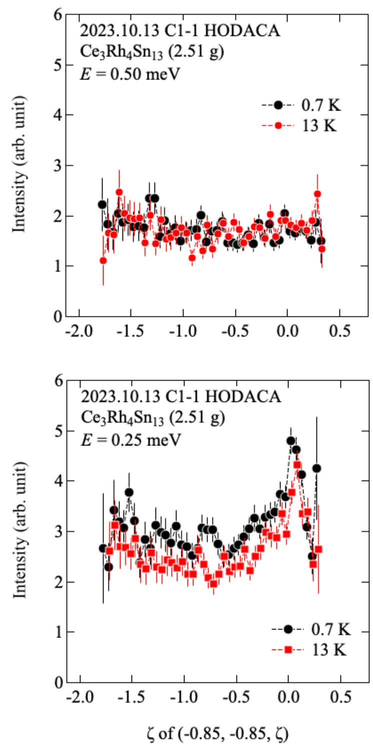

Fig. 1. INS spectra at $\boldsymbol{Q}$ = (–0.85, –0.85, ζ) at 0.7 and 13 K of $Ce_3Rh_4Sn_{13}$. The energy transfers are E = 0.50 meV (upper panel) and 0.25 meV (lower panel).