Magnetic excitations near ordering temperature in $Nd_3Co_4Sn_{13}$

K. Iwasa[A], W. Kurosawa[B], A. Shimoda[B], Y. Igura[B], K. Kuwahara[B], S. Asai[C], H. Kikuchi[C], T. Masuda[C]

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

The $Ln_3Co_4Sn_{13}$ class of materials show various electronic states accompanied with structural transformations [1, 2]. The *Ln* = Ce compound shows a Weyl–Kondo semimetal behavior [3], and the *Ln* = La compound is a superconductor below 2.7 K [4]. The electronic properties are caused by the topological electrons produced from the asymmetric spin–orbital effect under the chiral symmetry. In present study, we investigated magnetic excitations in $Nd_3Co_4Sn_{13}$, which was reported to show a structural superlattice below 124 K and antiferromagnetic ordering at $T_N = 2.1$ K [5, 6]. Recently, the investigator group revealed details of the crystal structure transitions and antiferromagnetic structure of the isomorphic compound $Nd_3Rh_4Sn_{13}$, characterized by the chiral symmetry of the $I2_13$ space group [7].

Inelastic neutron scattering (INS) experiments for the coaligned single-crystal samples of $Nd_3Co_4Sn_{13}$ synthesized using the molten Sn-flux method were performed at the cold-neutron triple-axis spectrometer HER (C1-1). Measurements were conducted with final neutron energy at 3.636 meV chosen by the focusing PG analyzer. Sample temperature was controlled using a ^{3}He cryostat.

Figure 1 shows INS spectra measured at the scattering vector $\boldsymbol{Q} = (1, 1, L)$ with $L = 0.2$–1.4 r.l.u. of $Nd_3Co_4Sn_{13}$ at 2.3 K near the magnetic ordering temperature T_N. Quasielastic scattering feature is seen without a significant *L* dependence of the spectral shape. However, the intensities measured at $L = 0$ and 1 are enhanced more significantly compared to the spectra measured near $L = 0.5$ and 1.5. The collective excitation measured at 0.4 K (the proposal number 22542, not shown here) exhibit clear dispersion relation as a function of *L*. The local minima of excitation energy are located at $L = 0$ and 1. These results indicate that the antiferromagnetic correlation emerges even in the higher temperature region near T_N. The magnetic susceptibility data of $Nd_3Co_4Sn_{13}$ show a suppression behavior below approximately 3 K above T_N, which was suggested to be a signature of an emergence of short-range correlation [5]. The present INS data showing the *L* dependence is consistent with the suggestion from the magnetic susceptibility.

The present study was performed under the approved proposal No. 23537.

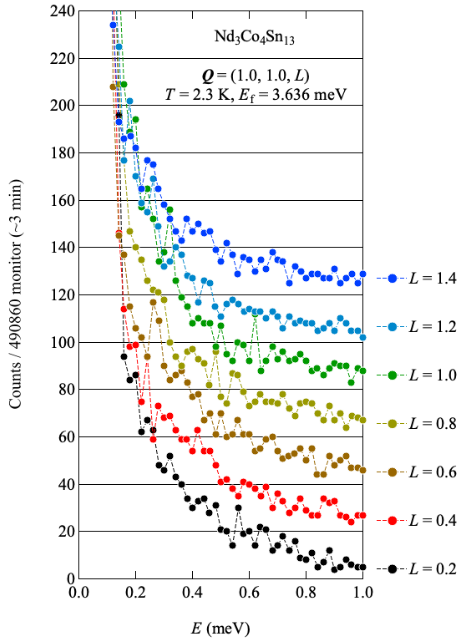

Fig. 1. INS spectra at $\boldsymbol{Q} = (1, 1, L)$ at 2 K of $Nd_3Co_4Sn_{13}$ at 2.3 K.

[1] Y. Otomo et al., Phys. Rev. B **94**, 075109 (2016). [2] J. Welsch et al., Phys. Rev. Mater. **3**, 2 (2019). [3] K. Iwasa et al., Phys. Rev. Mater. **7**, 014201 (2023). [4] Y. W. Cheung et al., Phys. Rev. B **93**, 241112(R) (2016). [5] C. W. Wang et al., J. Phys.: Condens. Matter **29**, 435801 (2017). [6] C. W. Wang et al., Physica B **551**, 12 (2018). [7] A. Shimoda et al., Phys. Rev. B **109**, 134425 (2024).