Determination of the Magnetic Structure under Magnetic Field of the Noncentrosymmetric Heavy-Electron Metamagnet $CePtSi_3$

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Non-centrosymmetric *f*-electron materials have attracted much attention because the lack of inversion symmetry leads to significant and interesting physical properties. Recently, we observed that the non-centrosymmetric $BaNiSn_3$-type compound, $CePtSi_3$, exhibits successive magnetic transitions, multiple metamagnetic transitions, yielding an unusually complex $H - T$ phase diagram. We defined three phases (III, II and I) at elevated temperature. From elastic neutron diffraction experiments at zero field performed last summer, we found that the magnetic peaks observed at the commensurate position in phase III and at the incommensurate position in phase I. In addition, the *h*- and *k*-domains coexist in $CePtSi_3$ at zero field.

In order to determine magnetic structures in $CePtSi_3$ under fields in the next step, we performed elastic neutron scattering experiments at BL-09 (CORELLI), SNS in Oak Ridge National Laboratory. A single crystalline sample of $CePtSi_3$ was grown using a flux method at the Institute for Solid State Physics. The sample was mounted on a Cu pin such that both the *a*- and *c*-axes set into the equatorial plane and installed in SlimSam. Temperature was set to 1.8 K, and a magnetic-field was applied from 0 to 50 kOe along the *h*-direction (the *a*-axis).

We succeeded in observing clear and interesting field-dependence of magnetic peaks (Figure 1). It was suggested that the field region from 5 to 20 kOe can be classified into two phases. The *k*-domain in the magnetic field region of 5 to 14 kOe is still in the commensurate phase, but the *h*-domain changes to the incommensurate phase, and its magnetic propagation vector, q_{2h}, changes from 0.283 to 0.31 and the scattering intensity decrease sharply. In the magnetic field region from 14 to 20 kOe, the *h*-domain saturates at q_{2h} = 0.31, and the scattering intensity of magnetic peaks further decreases and disappears at 20 kOe. On the other hand, in the *k*-domain at 14 to 20 kOe, an incommensurate phase of q_{1k} = 0.283 appears, which is a crossover region between the incommensurate and commensurate phase. Finally, all magnetic superlattice peaks disappear above 45 kOe because of forced ferromagnetism. We are in the process of determining the mechanism of such magnetic structures in field. Travel expenses were supported by General User Program for Neutron Scattering Experiments, Institute for Solid State Physics, The University of Tokyo (proposal no. 18508), at JRR-3, Japan Atomic Energy Agency, Tokai, Japan.

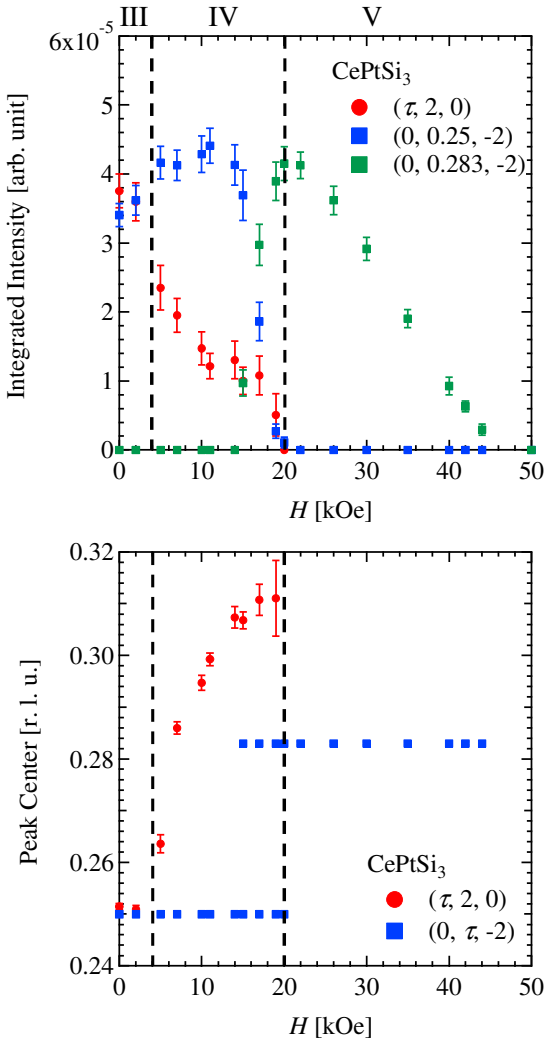

Fig. 1. Magnetic field dependence of the integrated intensity and peak position related to propagation vectors in *h*- and *k*-domains.