(O3-1)

Field-angle dependence of the low temperature specific heat of $PrOs_4Sb_{12}$

T. Sakakibara[1], A. Yamada[1], J. Custers[1], T. Tayama[1], H. Sugawara[2], Y. Aoki[3] and H. Sato[3]

[1]Institute for Solid State Physics, University of Tokyo, Kashiwa, 277-8581
[2]Faculty of Integrated Arts and Sciencies, Tokushima University, Tokushima 770-8502
[3]Graduate School of Science, Tokyo Metropolitan University, Hachioji, 192-0397

We have been studying the field-angel dependence of the specific heat $C(H,\theta)$ of $PrOs_4Sb_{12}$ to probe the superconducting gap symmetry. Previously, we reported that $C(H,\theta)$ exhibits a clear fourfold oscillation with minima along [100] in the whole field range below H_{c2}, when H is rotated in the (001) plane at low T. Interestingly, the fourfold oscillation was found to persist even slightly above H_{c2}, whose origin was not clear. Here we have extended the measurements to the normal state of $PrOs_4Sb_{12}$, in order to shed light on the electronic state of this system.

Fig. 1 shows some examples of the data taken in a field of 2.5 T ($> H_{c2} = 2.1$ T) rotated in the (001) plane. We clearly observed a fourfold oscillation in the normal state. Surprisingly, we found that the oscillation reverses the sign at $\sim$0.4 K. Fig. 2 shows the summary of the measurements we have done so far. The sign-reversal point moves in the $H-T$ plane as indicated. At present, we do not have any simple explanation for this normal-state $C(H,\theta)$ oscillations; neither CEF excitations nor Pr nuclear contribution gives the $C(H,\theta)$ oscillation of this magnitude. One possible origin might be the quadrupole fluctuations, which may contribute to $C(H,\theta)$ through the anisotropy in the transition field/temperature of the high-field AFQ phases. A strong oscillation is indeed observed within the AFQ phase (5.5 T) as expected from mean-field calculations.

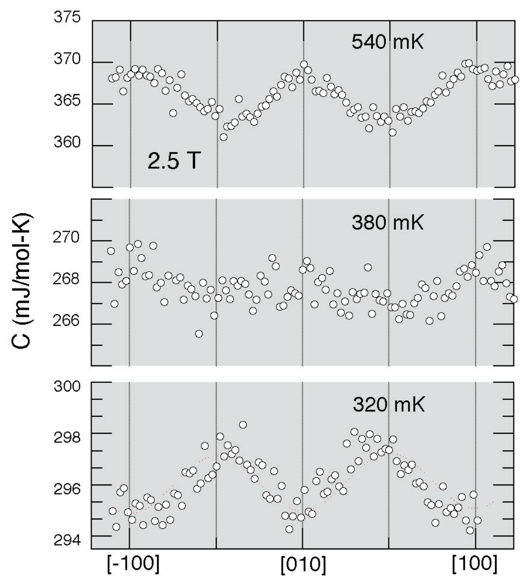

Figure 1: Field-angle dependence of the normal-state specific heat in a field H=2.5 T rotated in the (001) plane, obtained for three different temperatures.

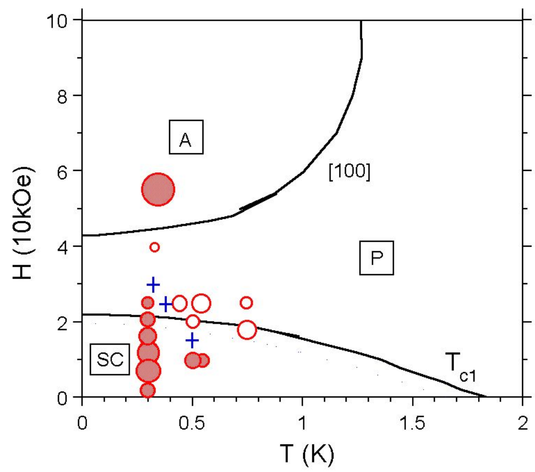

Figure 2: Fourfold oscillation amplitude in the $H-T$ plane. Solid (open) circles indicate the angular oscillations with minima (maxima) along [100]. Size of the symbols indicates the relative amplitude of the oscillation (not in scale). Crosses show the region where the oscillation vanishes.