3C/2008G190,2006G190

Spin, orbital and total magnetic form factor of rare-earth compound $CeRh_3B_2$ observed by X-ray magnetic diffraction

Ryouta NAGAYASU[1], Tatsuki TADENUMA[1], Kosuke SUZUKI[1], Yoshiaki OBA[1], Ayako SATO[1], Naruki TSUJI[2], Hiromichi ADACHI[3$], Keiichi HIRANO[3], Yoshiharu SAKURAI[4], Yoshichika ONUKI [5] and Masahisa ITO*[1]

[1]Graduate School of Eng., Gunma Univ., Tenjin-cho 1-5-1, Kiryu, Gunma 376-8515, Japan

[2]Advanc. Technol. Res. Center, Gunma Univ., Tenjin-cho 1-5-1, Kiryu, Gunma 376-8515, Japan

[3]KEK-PF, Oho 1-1, Tsukuba, Ibaraki 305-0801, Japan

[4]JASRI/ SPring-8, Kouto, Sayo-cho, Sayo-gun, Hyogo 679-5198, Japan

[5]Graduate School of Sci., Osaka Univ., Yamadaoka, 1-1 ,Suita, Osaka 565-0871, Japan

Introduction

A rare earth compound of $CeRh_3B_2$ has been attracting attention of researchers of solid state physics. One of the reasons is that this compound has the highest Curie temperature (Tc=115K) among the known Ce compounds with nonmagnetic constituents. In order to understand the specific property it would be helpful to study the magnetic structure of this compound.

X-ray magnetic diffraction (XMD) method has been used and applied to a single crystal of $CeRh_3B_2$. By this method we can observe the spin, orbital and total magnetic form factor. The aim of this study is to reveal the magnetic properties of this compound through the spin, orbital and total magnetic form factor obtained by the XMD experiment.

Experiments

We have used white beam of elliptically polarized synchrotron radiation from the bending magnet of BL3C. The sample crystal was irradiated by this beam and the diffracted X-ray intensity with 90 degree scattering angle was measured by a pure Ge SSD. The magnetic field of 2.15T was applied to the sample crystal. The angle α between the directions of sample magnetization and incident X-rays was set to 0, 90 and 135 degree, and the orbital, spin and the total magnetic form factor were measured, respectively.

Results and discussion

The obtained spin, orbital and total magnetic form factor ($\mu_L(k)$, $\mu_S(k)$ and $\mu(k)$) are shown in Fig. 1, Fig. 2 and Fig. 3, respectively. From these figures the followings are noted. (1) The signs of $\mu_S(k)$ are all negative. On the contrary, (2) the signs of $\mu_L(k)$ are all positive. (3) For each reciprocal point the absolute value of $\mu_L(k)$ is larger than that of $\mu_S(k)$. (4) The sings of $\mu(k)$ are changing from points to points and its absolute value would be smaller than those of $\mu_S(k)$ and $\mu_L(k)$. We will study the density distributions of spin, orbital and total magnetic moments in real space by the Fourier transform of these form factors.

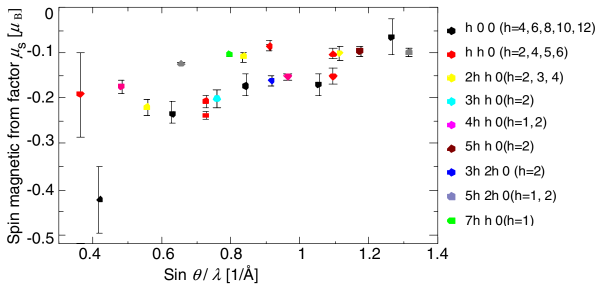

Fig. 1 Spin magnetic form factor.

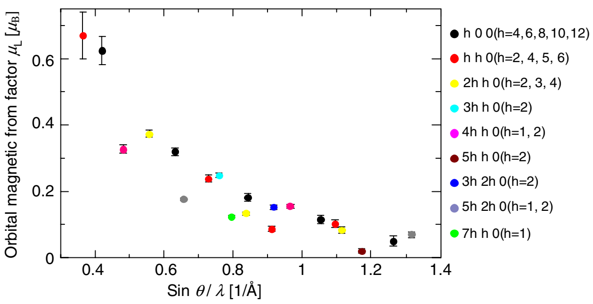

Fig. 2 Orbital magnetic form factor.

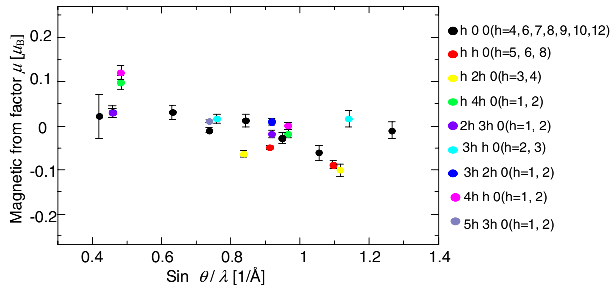

Fig. 3 Total magnetic form factor.

$Present address: Sch. Gen. Edu., Shinshu Univ., Asahi 3-1-1, Matsumoto, Nagano 390-8621, Japan.

*itom@phys.sci.gunma-u.ac.jp