

Spin-polarization in Ferromagnetic Superconductor UGe_2

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Introduction

After the discovery of superconductivity in ferromagnetic UGe_2 , the interplay between superconductivity and ferromagnetism has drawn much attention from the points of possible electron pairing mechanism via spin-fluctuation or magnetic excitations and existence of Fulde-Ferrell-Larkin-Ovchinnikov (FFLO) states. UGe_2 has a collinear magnetic structure with the ferromagnetically ordered moment of $1.4 \mu_B$. The Curie temperature $T_c = 52$ K at ambient pressure decrease under pressure, vanishing at 1.6 GPa. Around 1.2 GPa, UGe_2 becomes superconducting while remaining strongly ferromagnetic with a moment of $1\mu_B/U$.

A microscopic picture of magnetism provides a ground for developing a theory on the novel superconductivity. The group of first author has been conducting magnetic Compton scattering experiments and has found that the spin-polarized electron momentum density distributions (so-called magnetic Compton profiles, MCPs) are not accounted for by a simple U-5f atomic profile. This implies that U-6d electron could be spin-polarized. In this experiment, we have examined the spin-polarization of U-6d electrons by means of x-ray magnetic circular dichroism (MCD) measurements.

Experimental Details

The fluorescence x-ray intensities were recorded around the M_{II} , M_{III} , M_{IV} and M_V absorption edges of uranium using a Lytle detector, the MCD spectra were obtained from the fluorescence x-ray intensity spectra by consecutively reversing the polarity of the magnetic field. The temperature of the sample was 20 K. The magnetic field was 0.6 T along an easy axis (a-axis).

Results and Discussion

Figure 1 shows the fluorescence intensity spectra and the fluorescence difference (MCD) spectra around the uranium M_{IV} and M_V edges. MCD is clearly observed in the spectra, indicating the spin polarization of U-5f states. However, no MCD signal is observed in the uranium M_{II} and M_{III} spectra, which shows that U-6d electrons are not almost spin-polarized in ferromagnetic UGe_2 .

We are examining the results, in combination with the magnetic Compton scattering results, for elucidating the novel magnetism in UGe_2 .

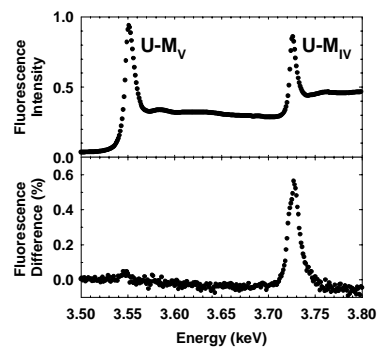


Fig.1(a) :
U- M_{IV} and U- M_V
spectra and MCDs.

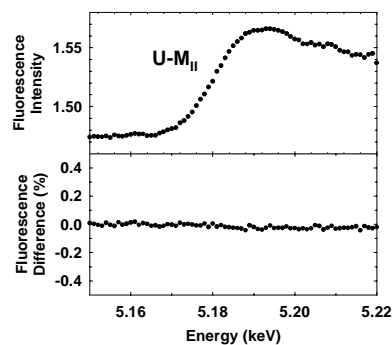


Fig.1(b) :
U- M_{II} spectra and
MCD.

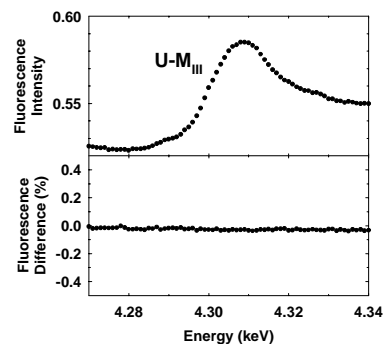


Fig.1(b) :
U- M_{III} spectra and
MCD.

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