

## Effect of uniaxial stress on frustrated antiferromagnetic states of UPd<sub>2</sub>Si<sub>2</sub>

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The ternary uranium compound UPd<sub>2</sub>Si<sub>2</sub> (the ThCr<sub>2</sub>Si<sub>2</sub> type body centered tetragonal structure) displays a variety of antiferromagnetic (AF) modulations [1-3]. In UPd<sub>2</sub>Si<sub>2</sub>, an incommensurate AF order with the ordering vector of  $Q_I=0.73c^*$  develops below  $T_{Nh}=135$  K, and it is replaced by a commensurate AF order with  $Q_{II}=1c^*$  below  $T_{NI}=108$  K. Furthermore, applying magnetic field suppresses both the  $Q_I$ - and  $Q_{II}$ -phases, and then induces the other AF phase with  $Q_{III}=(2/3)c^*$  above 6 T. These features on the AF modulations are considered to be ascribed to a frustration of inter-site interactions between uranium 5f moments along the tetragonal c axis. To clarify the nature of this frustration, we have investigated an effect of uniaxial stress on the AF phases in UPd<sub>2</sub>Si<sub>2</sub> by performing elastic neutron scattering measurements.

Uniaxial stress  $\sigma$  was applied to the tetragonal [010] direction of a single crystalline UPd<sub>2</sub>Si<sub>2</sub> up to 0.8 GPa. Figure 1 shows AF Bragg-peak profiles of commensurate and incommensurate AF orders. We found from temperature scans for AF Bragg-peak intensities that  $T_{NI}$  linearly increases with increasing  $\sigma$ , while  $T_{Nh}$  is nearly independent of  $\sigma$ . The rate  $T_{NI}/\sigma$  is estimated to be 4.3 K/GPa, suggesting that  $T_{NI}$  coincides with  $T_{Nh}$  at 5.4 GPa. The application of  $\sigma$  also affects the ordering vector in the  $Q_I$ -phase:  $Q_I$  at 115 K moves from  $0.736(2)c^*$  ( $\sigma=0$ ) to  $0.747(2)c^*$  ( $\sigma=0.8$  GPa). In contrast, the ordered moment at 1.5 K does not change from the value of 2.3  $\mu_B/U$  in the  $\sigma$  range presently investigated. We compare these experimental results with the recent investigations under hydrostatic pressure for UPd<sub>2</sub>Si<sub>2</sub> [4] as well as the

theoretical calculations based on the axial next nearest-neighbor Ising (ANNNI) model [3], and suggest that the magnitudes of three different inter-site interactions between uranium 5f moments play an important role in the competition of the AF orders.

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[2] B. Shemirani et al.: Phys. Rev. B 47 (1993) 8672.

[3] T. Honma et al.: J. Phys. Soc. Jpn. 67 (1998) 1017.

[4] H. Hidaka et al.: J. Phys.: Conf. Ser. 273 (2011) 012032.

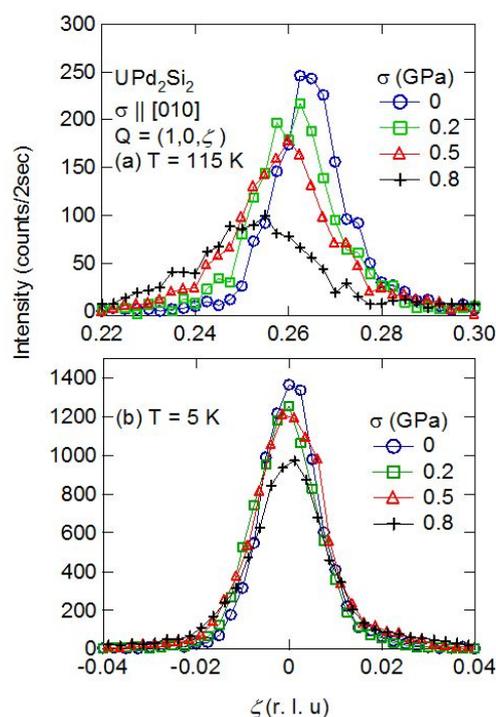


Fig. 1. AF Bragg-peak profiles for commensurate and incommensurate AF orders of UPd<sub>2</sub>Si<sub>2</sub>.