Physical properties and electronic structure of antiferromagnet $URhIn_5$

[1]Yuji Matsumoto, [2]Yoshinori Haga, [2]Naoyuki Tateiwa, [2]Etsuji Yamamoto and [3]Zachary Fisk

[1]*Faculty of Science, University of Toyama*
[2] *Advanced Science Research Center, Japan Atomic Energy Agency*
[3] *University of California , Irvine*

RTX$_5$ family (*R* = rare earth and actinide *T* = transition metal, *X* = In, Ga tetragonal $HoCoGa_5$ type structure) is one of the most studied system in the strongly correlated *f* electron system. In R = actinide, $PuCoGa_5$ which is heavy fermion superconductor with much higher transition temperature T_C = 18 K is intensively studied [1]. In R = U, $UTGa_5$ compounds only have been reported and they exhibit antiferromagnetism or enhanced Pauli-paramagnetism [2, 3]. There was no $UTIn_5$ compounds so far. Therefore we have searched for $UTIn_5$ compounds. As a result, single crystals of $URhIn_5$ have been obtained [4].

We have measured the magnetic properties, electrical resistivity and specific heat of $URhIn_5$. $URhIn_5$ is an antiferromagnet with antiferromagnetic transition temperature T_N = 98 K. The moderately large electronic specific heat coefficient γ = 50 mJ/K^2 mol demonstrates the contribution of 5*f* electrons to the conduction band. On the other hand, magnetic susceptibility in the paramagnetic state roughly follows a Curie-Weiss law with a paramagnetic effective moment corresponding to a localized uranium ion. The crossover from localized to itinerant character at low temperature may occur around the characteristic temperature 150 K where the magnetic susceptibility and electrical resistivity show a marked anomaly.

We have also performed the de Hass- van Alphen (dHvA) effect measurement of $URhIn_5$ to obtain its electronic structure [5]. By analyzing the dHvA oscillations, existence of two Fermi surfaces was concluded.

Reference:

[1] J. L. Sarrao, et al., Nature **420,** 297 (2002).

[2]N. O. Moreno, et al., Phys. Rev. B **72**, 035119 (2005).

[3]S. Ikeda, et al., Physica B **359-361**, 1039 (2005).

[4] Y. Matsumoto, et al., Phys. Rev. B **88**, 045120 (2013).

[5] Y. Matsumoto, et al., JPS Conf. Proc., **3**, 011097 (2014).