Neutron scattering study on magnetic properties of $PrCu_4T$ (T = Au and Ag)

H. KOBAYASHI, K. SAITO, K. TOMIYASU, K. IWASA

S. ZHANG[1], Y. ISIKAWA[1], J.-M. MIGNOT[2], A. GILLET[2]

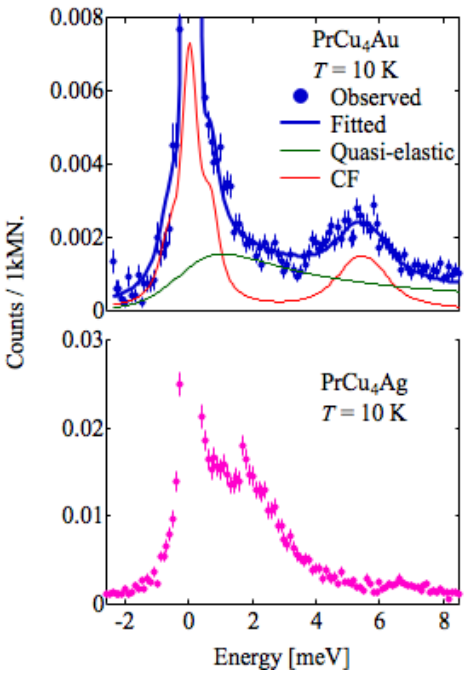
Department of Physics, Tohoku University, Sendai 980-8578, Japan

[1]Graduate School of Science and Engineering, University of Toyama, Toyama 930-8555, Japan

[2]Laboratoire Léon Brillouin, CEA-CNRS, CEA/Saclay, 91191 Gif sur Yvette, France

Pr-based compounds have been studied for various electron properties arising from $4f^2$ electron configuration hybridizing strongly with conduction electron as in $PrFe_4P_{12}$[1]. $PrCu_4T$ (T = Au and Ag) crystallizing into a $MgCu_4Sn$-type crystal structure are considered as examples of such correlated electron systems. $PrCu_4Ag$ and $PrCu_4Au$ undergo antiferromagnetic transitions below T_N = 2.4 K and 2.5 K, respectively. Their crystal-field-splitting (CF) ground states are magnetic triplet Γ_5, investigated by the magnetization[2,3]. Specific heat measurements show that $PrCu_4Au$ has the large electronic specific heat coefficient γ = 0.77 J / mol K. This fact indicates that $PrCu_4Au$ is a heavy fermion system[2]. On the other hand, it is thought that C/T of $PrCu_4Ag$ has a small value at the zero-temperature limit[3].

To understand these properties of the localized electron exhibiting magnetic ordering and of the itinerant electron deduced from the specific heat, we performed neutron diffraction and inelastic neutron scattering (INS) measurements. A figure shows the INS spectra of $PrCu_4T$. The spectrum of $PrCu_4Au$ is composed of a broad quasi-elastic response (a green line) and sharp peaks (a red line) due to the CF excitation. All $4f^2$ levels exist within 11 meV, so various degrees of freedom affect the properties in low temperature.The spectrum of $PrCu_4Ag$ may also be reproduced with large contribution of the quasi-elastic scattering, superimposed with the three peaks in the lower energy region. The former contribution is considered to indicate strong hybridization for Pr f^2 electron state, in contrast to the smaller C/T value $PrCu_4Ag$ than $PrCu_4Au$. We will report these INS spectra and the magnetic structures, for elucidating the electronic states of $PrCu_4T$.



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