(28d4)

Neutron scattering study on a heavy fermion superconductor $CePt_3Si$

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$CePt_3Si$ [1] exhibits an antiferromagnetic order at $T_N = 2.2$ K and enters into a heavy fermion superconducting state at $T_c \approx 0.75$ K. The large Sommerfeld constant $\gamma = 400$ mJ/molK^2, large effective mass $m^* \approx 200\ m_0$, and the T^2 coefficient in resistivity $A = 2.32$ cm/K^2 with the Kadowaki-Wood ratio $A/\gamma^2 = 1\times10^{-5}\mu\Omega$cm(molK/mJ)^2 indicate a fermi liquid state with significant renormalization due to electron correlation. The large $dH_{c2}/dT \approx -8.5$ T/K and $H_{c2} \approx 5$ T suggest that Cooper pairs form out of the heavy quasi-particle state. There is a conflicting situation; A lack of inversion center favors spin singlet pairing, while the large H_{c2} exceeding estimated Pauli-Clogston limiting field might be signature for spin triplet pairing. It was suggested that a mixed spin singlet and triplet pairing state might be the answer to the apparent paradox.

We observed clear antiferromagnetic Bragg reflections with $q = (0\,0\,1/2)$, indicating that magnetic moments of Ce lying ferromagnetically in the c-plane with an inversion center, and are stacked antiferromagnetically along the c-axis with lack of inversion symmetry. The magnitude of magnetic moment is deduced to be $0.17(1)\mu_B$/Ce. Clear crystal field excitations at 1 meV and 24 meV were observed. The magnetic susceptibility can be well explained with level scheme assuming the Γ_7 ground state with Γ_6 and Γ_7, as the first and second excited states, respectively [2].

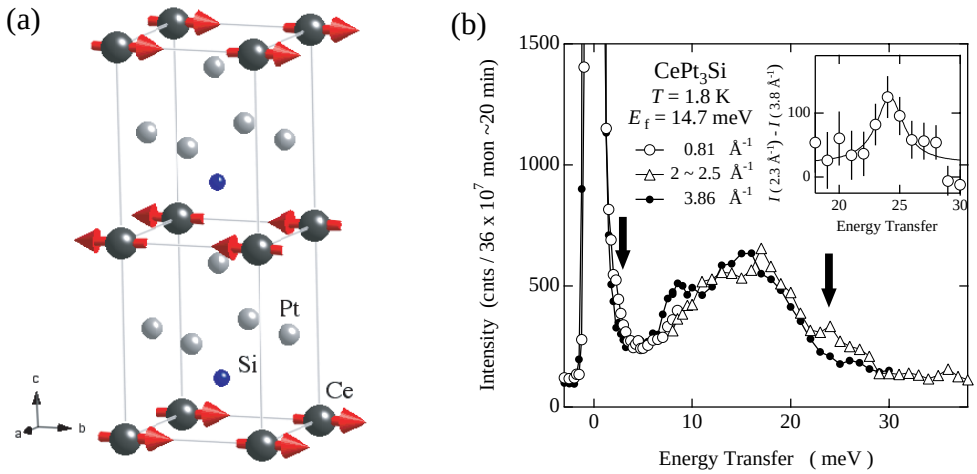

Figure 1: (a) Crystal and magnetic structure of $CePt_3Si$. The arrows on the Ce atom indicate the magnetic moment lying, with unspecified orientation, in the basal c plane.(b) Neutron inelastic scattering profile of $CePt_3Si$.

[1] E. Bauer et al., *cond-mat/0308083*.
[2] N. Metoki et al., submitted to JPSJ Letter.