ESRF	**Experiment title:** Hybridisation in dhcp Ce-Y alloys	**Experiment number:** HE-705
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Report:

Cerium is one of the most fascinating elements in the periodic table and, as a consequence, it has been studied intensely for many years using theoretical techniques. X-ray magnetic resonant scattering (XMRS) offers a new experimental approach to the study of Ce-based systems. Alloying with nonmagnetic yttrium stabilizes the DHCP phase, and single-crystal samples suitable for magnetic diffraction experiments have been grown using molecular beam epitaxy. The magnetic structure has been determined using neutron diffraction, and the results are consistent with a transverse antiferromagnetic structure with propagation vector (1/2,0,0). The XMRS at the Ce L_{II} edge has been studied using the magnetic scattering beam line ID20 at the ESRF for an alloy of composition $Ce_{0.9}Y_{0.1}$.

Scans of wave-vector transfer through the magnetic reflection at $\boldsymbol{Q}$ = (1/2,0,6) have been performed as a function of x-ray energy, and the integrated intensities reveal two resonances. The main peak occurs at E = 6.163 keV, which is 2eV above the Ce L_{II} absorption edge. This

is assigned to an electric dipole transition from a *2p* core level to the *5d* band. A smaller feature is observed 7eV lower in energy, and this is attributed to a quadrupolar transition of a *2p* core electron to the *4f* level.

The higher energy resonance found in spectroscopic studies of Ce-Ho (ESRF Experimental Report HE-480) is absent. This peak, which is found in the high-pressure FCC phase α-Ce, but is small in the low-pressure phase γ-Ce, is the signature of intermediate-valence behaviour. Thus we conclude that the Ce in this dilute Ce-Y alloys forms an ideal system with the localized *4f* electrons characteristic of the other lanthanides.

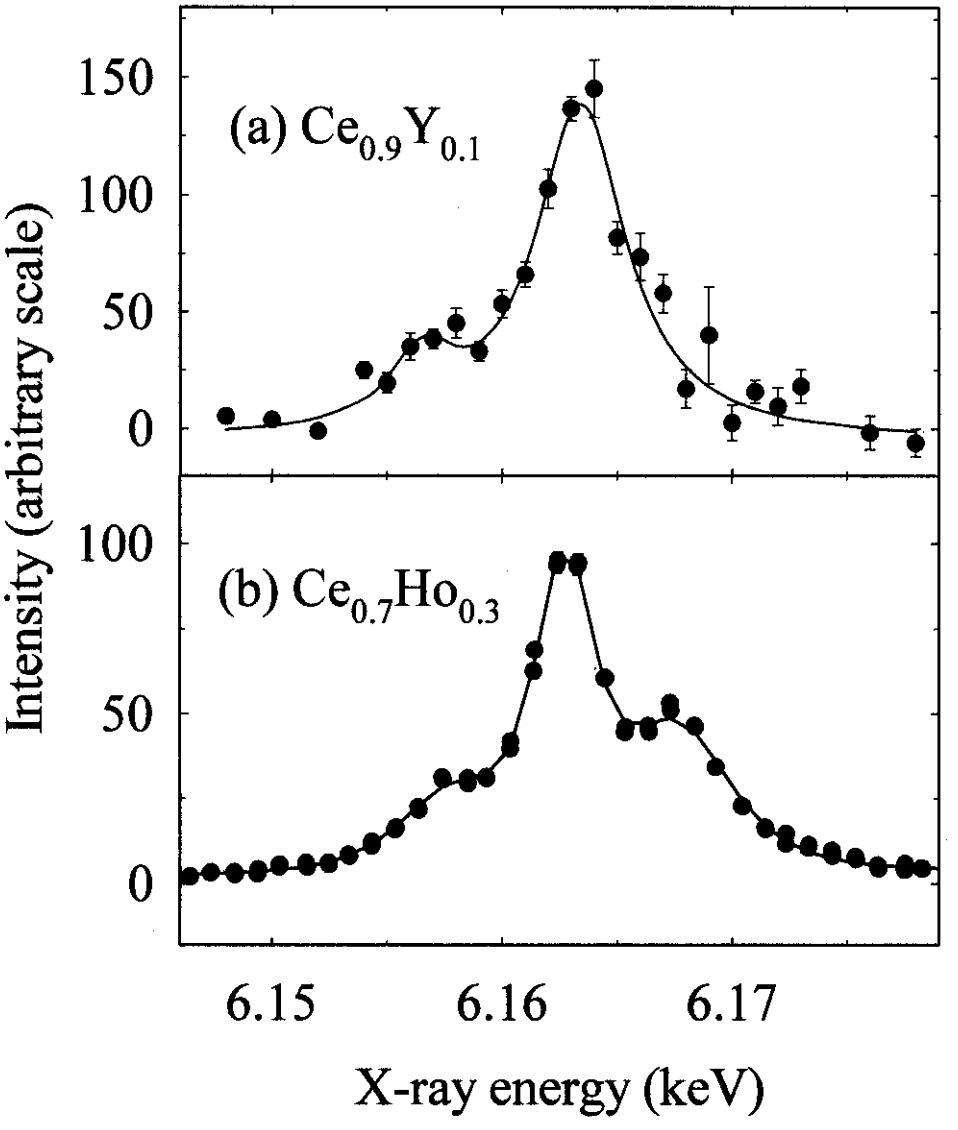

Figure 1. Scans of x-ray energy in the π-σ channel with $\boldsymbol{Q}$ fixed at magnetic reflections at $T \sim$ 2 K (a) for $Ce_{0.9}Y_{0.1}$ and (b) for $Ce_{0.7}Ho_{0.3}$. The absence of the high-energy peak for $Ce_{0.9}Y_{0.1}$ shows that its valence is close to +3.