Experiment number 28-01-716

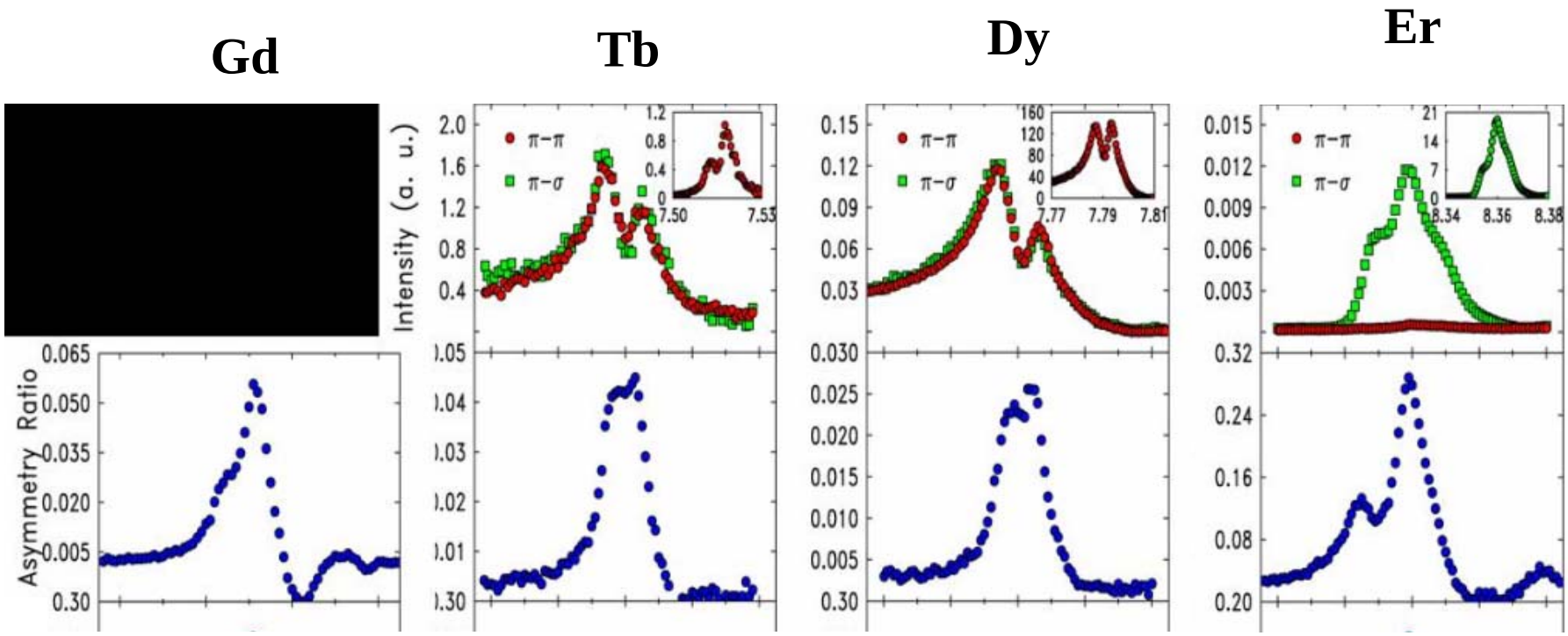
During in-house time, the spitting of the d-band was observed in holmium [1]. The aim of the experiment was to check if all the other rare-earths showed the same feature.

The experiment was carried on resonance scattering horizontally close to 90° with the magnetic field applied vertically. In this geometry, the cross-section shows that the quadrupole is virtually turned off when scattering at 90°. The vertical size of the beam was maintained at 0.2 mm to have a very high degree of linear polarization. The energy was tuned to the L_3 edge of Dy, Er, Tb and Gd individually.

We looked alternatively at the ferromagnetism (FM) and antiferromagnetism (AFM) phases of Dy, Er and Tb, and at the FM for Gd (see figures). The FM was measured with the bicron looking straight through (bottom curves), whereas for the AFM (top curves) we looked at both the π-π (red curves) and π-σ (green curves) channels with a polarization analyzer. Analysis of the cross-section shows that there is hardly any quadrupole contribution in the π-π channel. The presence of the double peak in this channel (dipole) indicates that the d-band is split. This is further confirmed with the FM data. We also performed transmission measurements through 5 μm thick foils in order to correct the AFM data (see insets for corrected data).

We proved that the heavy rare-earths exhibit a d-band split illustrated by the presence of a double peak in both the FM and AFM data. Both peaks are of dipole origin unlike what was published before [2].

[1] private communication.
[2] Hill & McMorrow, Acta. Cryst. A **52**, 236 (1996).


Gd
Tb
Dy
Er
Intensity (a. u.)
Asymmetry Ratio
π−π
π−σ