Measurement of the X-ray emission anisotropies in the resonant photorecombination into highly charged ions

C. Shah[1], P. Amaro[1], R. Steinbrügge[2], S. Bernitt[2], Z. Harman[2], S. Fritzsche[3], A. Surzhykov[4], J.R. Crespo López-Urrutia[2], and S. Tashenov[1]

[1] *Physikalisches Institut, Im Neuenheimer feld 226, 69120 Heidelberg, Germany*
[2] *Max–Planck–Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany*
[3] *Friedrich-Schiller-Universität Jena, Fürstengraben 1, 07743 Jena, Germany*
[4] *Helmholtz-Institut, Helmholtzweg 4, 07743 Jena, Germany*

Presenting Author: chintan@physi.uni-heidelberg.de

We report the first systematic measurement of the photon angular distribution in the inter-shell dielectronic recombination (DR) and trielectronic recombination (TR) into highly charged ions. Iron and krypton ions in the He-like through O-like charge states were produced in an electron beam ion trap, and the electron-ion collision energy was scanned over the K-shell recombination resonances. An excellent electron energy resolution of 6.5 eV FWHM at 5 keV for iron and 11.5 eV FWHM at 9 keV for krypton was achieved.

The X rays emitted in the decay of resonantly excited states were simultaneously recorded by two germanium detectors which were mounted along and perpendicular to the electron beam propagation directions. The intensities of K-shell X-ray transitions were recorded as a function of electron beam energy. The measured photon emission asymmetries indicate the alignment of the corresponding excited states. Morever, the alignment properties of the weaker processes such as TR were measured for the first time.

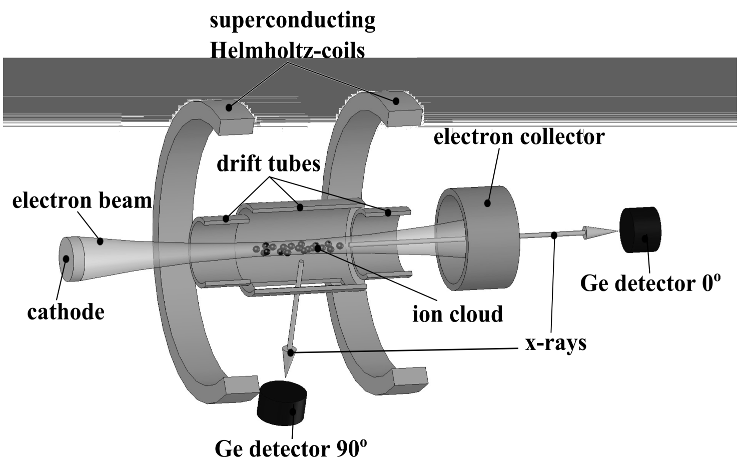

Figure 1: *Scheme of the experimental setup.*

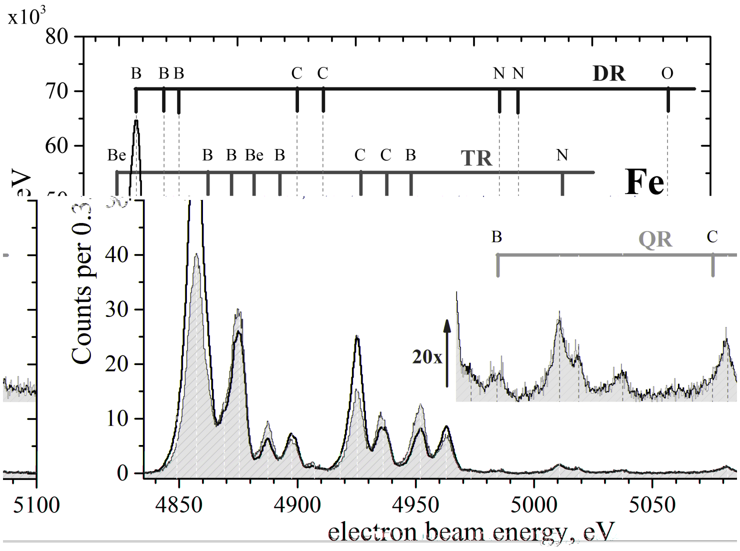

Figure 2: *X-ray intensity as a function of the electron beam energy. The solid line shows the X-ray intensity perpendicular to the electron beam propagation direction, whereas the filled area indicates intensity along the electron beam propagation direction. Vertical markers represent the resonant recombination processes and corresponding initial charge state of the ions.*

The measured X-ray emission anisotropies probe the electron-electron interaction in the strong field of the ion, e.g. they are highly sensitive to the Breit interaction. These results benchmark dedicated multiconfiguration Dirac-Fock electronic structure calculations and can be applied for polarization diagnostics of hot astrophysical and laboratory fusion plasmas.