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Measurement of the angular distribution of Dielectronic Recombination into highly charged Krypton ions

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Synopsis Angular distribution of x-rays emitted in the process of Dielectronic Recombination (DR) was studied at the Electron Beam Ion Trap. For this the photon emission spectra were observed along and perpendicular the electron beam propagation direction. X-ray line intensities differ drastically between the two acquired spectra. This indicates a strong alignment of the total angular momentum vector of the excited states populated by DR with respect to the electron beam propagation direction.

We report studies of the angular distribution of X-rays produced by Dielectronic Recombination of highly charged ions. Krypton ions in He-like through O-like charge states were generated in an electron beam ion trap. The electron-ion collision energy was scanned over a range of DR resonances exciting K-shell electrons. The subsequent photon emission was recorded by two germanium detectors arranged along and perpendicular to the electron beam probagation direction. The intensities of the radiative transitions were recorded as a function of the electron beam energy, see Figure 1. The electron energy resolution of 18 eV was achieved by forced evaporative cooling technique.

A number of DR resonances are prominent in both spectra. The intensities of some of these resonances differ when observed along and perpendicular to the electron beam axis. The reason for these differences is the aligment of the total angular momentum vector of the excited state with respect to the electron beam axis. Alternatively it indicates a nonstatistical population of the magnetic sublevels of the intermediate excited state. The decay radiation of such an aligned state is strongly anisotropic, which was observed in the experiment. The isotropic decay of the states with *j=1/2* was used for normalization.

The alignment of the states populated by DR probes the dynamics of this process due to the electron-electron interaction in the strong electromagnetic field of the target ion. It was shown to be sensitive to the fine details of this interaction, in particular to the relativistic and magnetic effects. For this reason it may serve as a test for atomic calculations.

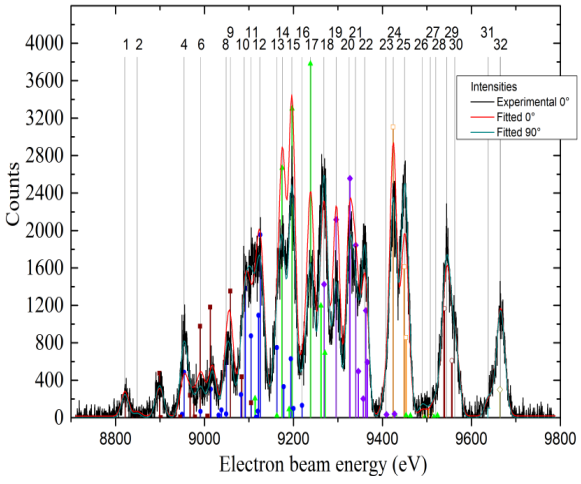

Figure 1. Intinsitiy of the radiative decay as a function of the electron beam energy.

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