4 - 5 Dielectronic Recombination of Li-like Argon Ions at the CSRm*

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The main cooler storage ring (CSRm) equipped with an electron-cooler creates an ideal platform for dielectronic recombination (DR) experiments. In order to fully understand our DR experimental setup and especially the electron energy detuning system, we have performed a DR calibration experiment using the Li-like argon ions at the CSRm. The Ar^{15+} has a simple electronic structure so the DR spectrum can be calculated with an ultra-high precision and compared with the existing experimental data. The experiment was carried out at the relative energy from 0 to 32 eV that includes all DR resonances associated with $2s_{1/2} \rightarrow 2p_{1/2}$ and most of the $2s_{1/2} \rightarrow 2p_{3/2}$ excitations.

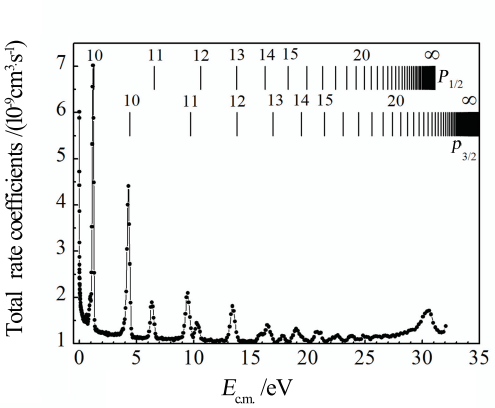

Fig. 1 (color online) The measured total rate coefficients for $^{36}Ar^{15+}$ions as a function of the relative energy between electron beam and ion beam. The DR resonances involve Δn=0 transition of the 2s core electron. The energy of the Rydberg states with configurations $1s^2 2p_{1/2} nl$ and $1s^2 2p_{3/2} nl$ populated during recombination process are indicated by vertical lines.

The lithium-like Ar^{15+} ions were injected into the CSRm at an energy of 8.37 MeV/u. The 35 kV electron cooler was also used as an electron target in the DR experiment. The cooling point and density of the electron beam are -4.581 kV and 1×10^6 cm^{-3}, respectively. After several seconds of cooling, the momentum spread of the ion beam was reduced to 2×10^{-4}. The detuning voltage was applied to the cathode of the electron cooler to change the electron energy with a step of 2 V in the present measurements. For each single detuning voltage, the timing scheme is set for detuning for 10 ms and cooling for 90 or 190 ms in order to maintain a good beam quality. Fig. 1 shows the measured total rate coefficients of Ar^{15+} ions as a function of the relative energy between the electrons and ions at the CSRm. The achieved energy resolution is about 200 MeV. The present results are in good agreement with the two previous DR experimental results of Li-like argon ions at UNILAC- GSI[1] and at CRYRING- Stockholm[2].

References

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