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# Dielectronic recombination of lithiumlike $Xe^{51+}$ ions: Storage ring experiment and theoretical calculations

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**Synopsis** Absolute rate coefficients for dielectronic recombination (DR) of Li-like $^{136}Xe^{51+}$ have been measured at the heavy-ion storage ring ESR. The experimental results are compared with relativistic distorted-wave calculations employing the multiconfiguration Dirac-Fock method. Based on the DR measurements the $2s-2p_{1/2}$ and $2s-2p_{3/2}$ excitation energies in Li-like $Xe^{51+}$ were determined with a relative accuracy of ∼400 ppm.

Absolute rate coefficients for dielectronic recombination (DR) of Li-like $^{136}Xe^{51+}$ have been measured by employing the electron-ion merged-beams technique at the experimental storage ring (ESR) at GSI in Darmstadt, Germany. The present DR measurement closes the gap between measurements for lighter Li-like ions at TSR [1] and earlier results of heavy Li-like ions [2].

The investigated center-of-mass energy range 0 – 505 eV covers all $^{136}Xe^{50+}(2p_{1/2}\ nl_j)_J$ and $^{136}Xe^{50+}(2p_{3/2}\ nl_j)_J$ DR resonances associated with $2s$ – $2p$ excitations. Strengths and energies of isolated $(2p_{1/2}\ n)$ and $(2p_{3/2}\ n)$ DR-resonance groups have been determined for principal quantum numbers $n$ up to 43 and 36, respectively.

In addition to our experimental measurements we have performed relativistic distorted-wave calculations employing the multiconfiguration Dirac-Fock (MCDF) method. Figure 1 shows a comparison of measured DR-rate coefficients and corresponding theoretical results – taking into account the experimental electron velocity distribution – for the $^{136}Xe^{51+}(2s)+e^-\rightarrow{}^{136}Xe^{50+}(2p_{3/2}\ 9l_j)_J$-DR resonance group.

We find excellent agreement between experimental and theoretical resonance structures. By extrapolating measured DR-resonance positions to $n\rightarrow\infty$ the $2s-2p_{1/2}$ and $2s-2p_{3/2}$ excitation energies were determined. These results are compared with calculations (e.g. [3]) and results from beam-foil-spectroscopy [4, 5].

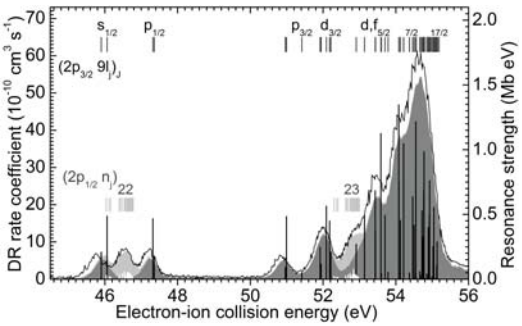


**Figure 1**. Small part of the measured $^{136}Xe^{51+}$-DR spectrum (black solid line) in the energy range of the $Xe^{51+}(2s)+e^-\rightarrow Xe^{50+}(2p_{3/2}\ 9l_j)_J$ resonance group. Results of MCDF-calculations, convoluted with the experimental electron velocity distribution and shifted by -0.29 eV and -0.4 eV are shown as dark and light shaded curves for the $(2p_{3/2}\ 9l_j)_J$ and $(2p_{1/2}\ nl_j)_J$ resonances, respectively. Corresponding resonance strengths are given by black and white vertical lines, respectively while shifted energies are indicated by dark grey and light grey vertical bars, respectively.

## References

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