Target Z-dependence of Cross Sections for Multiple Electron Loss by 6 A MeV Xe^{18+} Ions

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As part of an ongoing effort to examine the systematic behavior of cross sections for electron capture and loss by fast ions of relatively high atomic number, this year we have focused our attention on the task of investigating the dependence of multiple electron loss on target atomic number. Measurements of multiple electron loss cross sections have been carried out for 6 A MeV Xe^{18+} ions in thin (monatomic) targets of He, Ne, Ar, Kr, and Xe. The experimental methods employed were identical to those described in reference [1].

The dependence of the total electron loss cross section on target atomic number is shown in Fig. 1. It may be seen that the data appear to lie along two straight lines, with the He and Ne points defining a line having a relatively steep slope and the rest of the points defining a line having a significantly smaller slope. This behavior is remarkably similar to that observed by Alton et al. [2] for 0.36 A MeV Fe^{4+} ions. Cross sections for electron loss as a function of Δq (the number of electrons removed from the projectile) are shown in Fig. 2. The cross sections for the He target are reasonably well represented by a single exponential function (solid line), whereas the cross sections for the other targets display a dependence on Δq that requires two exponential components to describe. This is because the rate of decrease in cross sections for $\Delta q \geq 4$ as a function of Δq slows dramatically with increasing target atomic number. The second exponential component may reflect the effect of Auger decay, which should become an increasingly important mechanism for electron loss as electrons are removed from inner shells in high multiplicity (i.e., small impact parameter) collisions.

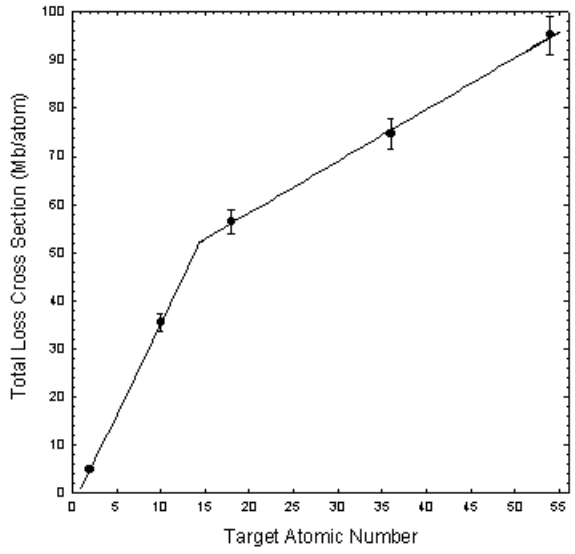

Figure 1: Total electron loss cross sections for 6 A MeV Xe^{18+} ions in noble gas targets.

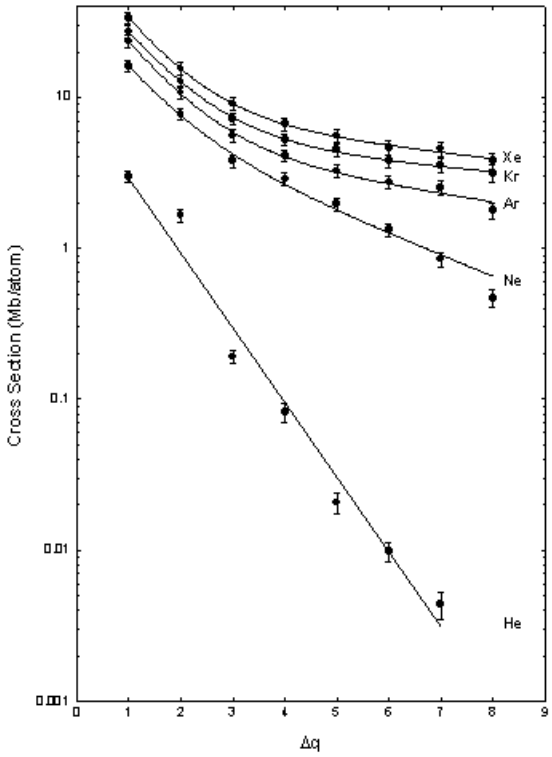

Figure 2: Single and multiple electron loss cross sections plotted as a function of the number of electrons removed from the incident Xe^{18+} ion.

References

[1] R. E. Olson, R. L. Watson, V. Horvat, and K. E. Zaharakis, J. Phys. B **35**, 1893 (2002).

[2] G. D. Alton, L. B. Bridwell, M. Lucas, C. D. Moak, P. D. Miller, C. M. Jones, Q. C. Kessel, A. A. Antar, and M. D. Brown, Phys. Rev. A **23**, 1073 (1981).