A.7.2. Triple Photo-Ionization of Lithium--*B.D. DePaola and Y. Azuma**

The investigation of multiple-ionization processes of atoms and molecules is of fundamental importance for understanding the interactions among charged particles in a Coulomb field, *e.g.,* electrons and ions in a plasma. Although multiple ionization appears to be a simple process, even the interaction of three charged particles cannot be described analytically, implying that the theoretical treatment may be challenging. Only in the past few years, for example, has agreement between theory and experiment finally been achieved in many aspects of double-ionization. Over the years, experimental investigations into double-ionization by both charged particles as well as by photons have proven very useful as a guide to theory. However, in contrast to charged particles, ionization by a single photon (except for Compton scattering) has a well-defined energy and angular momentum transfer from the projectile to the target, and provides a simpler testing ground for theoretical models. To date, triple photo-ionization experiments have also not been ideally suited for comparison to experiment due to the multitude of channels through which two or three of the electrons could be ionized (for a target with more than three electrons) since photo-ionization followed by auto-ionization could arise through many different channels. However, for the triple photo-ionization of lithium by a single synchrotron photon, no such ambiguity exists. In an experiment carried out at KEK's Photon Factory in Tsukuba, Japan, we have measured [Publication #112] absolute cross sections for triple photo-ionization of the three-electron system, lithium, for the first time. We have also measured the triple-to-single photo-ionization ratio between 187 and 424 eV. As shown in the figure below, one can observe that the ratio rises from threshold at 203.4 eV to about 300 eV, and then appears to level off for photon energies up to 430 eV at a value of about 0.0066%. The first simple theoretical estimate of the ratio at the high-energy limit, based on the shake-off model, yields a value of 0.0015% which is a factor of 4 lower than our experimental values. The triple-photo-ionization cross section is low, as expected, never rising more than 6 barns in the photon region of interest.

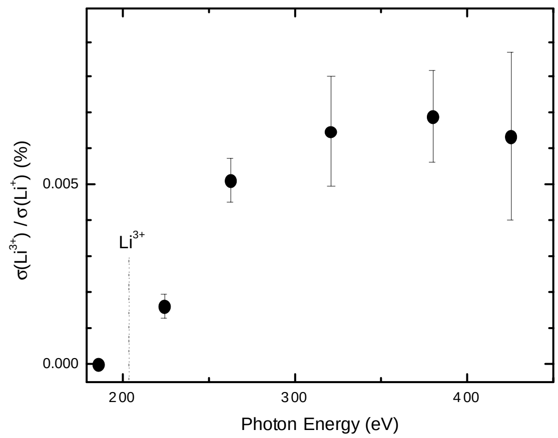

Figure 1. Triple to single photo-ionization cross section ratios *versus* photon energy. The threshold for triple photo-ionization is indicated by the dashed line.

*Photon Factory, IMSS, KEK, Tsukuba, Ibaraki 305-0801 Japan.