# First light on 3d photoionization of multiply charged xenon ions: a new photon-ion merged beam setup at PETRA III

S. Ricz[1*], S. Schippers[1], T. Buhr[1,7], K. Holste[1], A. Borovik Jr. [1], J. Hellhund[1], H.-J. Schäfer[1], D. Schury[1], S. Klumpp[2], K. Mertens[2], M. Martins[2], R. Flesch[3], G. Ulrich[3], E. Rühl[3], J. Lower[4], T. Jahnke[4], D. Metz[4], L. P. H. Schmidt[4], M. Schöffler[4], J. B. Williams[4], R. Dörner[4], L. Glaser[5], F. Scholz[5], J. Seltmann[5], J. Viefhaus[5], A. Dorn[6], A. Wolf[6], J. Ullrich[7], and A. Müller[1]

*[1]Institut für Atom- und Molekülphysik, Universität Giessen, 35392 Giessen, Germany*
*[2]Institut für Experimentalphysik, Universität Hamburg, 22761 Hamburg, Germany*
*[3]Institut für Chemie und Biochemie, Freie Universität Berlin, 14195 Berlin, Germany*
*[4]Institut für Kernphysik, Goethe-Universität Frankfurt, 60438 Frankfurt am Main, Germany*
*[5]FS-PE, DESY, 22607 Hamburg, Germany*
*[6]Max-Planck-Institut für Kernphysik, Heidelberg, 69117 Heidelberg, Germany*
*[7]Physikalisch-Technische Bundesanstalt, 38116 Braunschweig, Germany*
**Permanent Address: ATOMKI, Debrecen, Hungary*
Stefan.Schippers@physik.uni-giessen.de, Alfred.Mueller@iamp.physik.uni-giessen.de

The Photon-Ion Spectrometer at PETRA III, PIPE, is an experimental setup for studying interactions of photons with charged particles [1, 2]. Target species are provided in the form of ion beams. Ion masses up to q x 50000 u at energies of q x 2.4 keV can be accommodated for q-fold charged ions. Possible target species are atomic and molecular ions or electrically charged clusters, fullerenes, biomolecules and nanoparticles. Photo-ionization and photofragmentation will be studied. Photo-ions, photo-fragments, photo-electrons and photon-induced fluorescence light will be observed. PIPE is a permanent end station of the Variable Polarization XUV beamline P04 at PETRA III.

P04 is designed to provide synchrotron radiation at energies 250 eV to 3000 eV with a photon flux of $10^{12}$ photons per second at 0.01% bandwidth; $10^{13}$ photons per second are possible at lower resolution. The photon beam diameter in the merged-beam interaction region of PIPE is less than 1 mm. In a first experiment relative cross sections were determined for several channels of multiple ionization $h\nu + Xe^{q+} \rightarrow Xe^{(q+n)+} + ne$ (n = 2, 3, 4, 5) associated with Coster-Kronig and Auger cascades following the initial creation of a 3d vacancy. An example for the experimental results obtained is shown in figure 1. Along the xenon isonuclear sequence the resonance structure drastically changes from broad features at the 3d edge for Xe+ ions to relatively narrow resonances at the higher charge states.

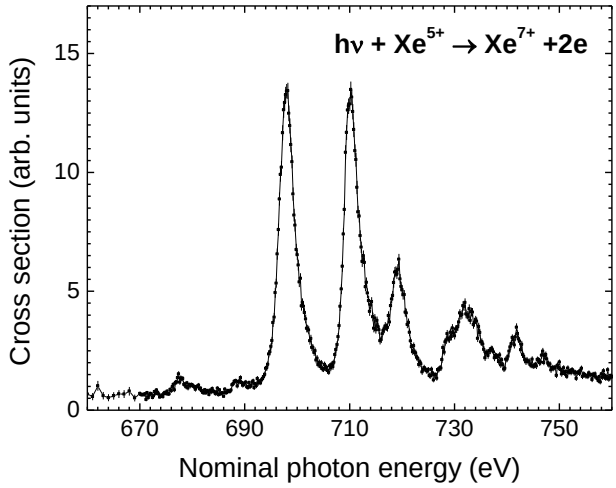


**Figure 1**. Photoionization yield of $Xe^{7+}$ ions produced from $Xe^{5+}$ parent ions by synchrotron radiation with energies near the 3d ionization threshold.

References:
[1] T. Ricsóka et al.,
J. Phys.: Conf. Ser. **194**, 142012 (2009).
[2] S. Schippers et al.,
J. Phys.: Conf. Ser. **388,** 142016 (2011).