PAPER • **OPEN ACCESS**

Upgrade of ESA-22D photoelectron spectrometer

To cite this article: Levente Ábrók *et al* 2015 *J. Phys.: Conf. Ser.* **635** 092092

Journal of Physics: Conference Series **635** (2015) 092092 doi:10.1088/1742-6596/635/9/092092

Upgrade of ESA-22D photoelectron spectrometer

Levente Ábrók*[1], Róbert Balog*†, Péter Herczku*†, Sándor Kovács*†, Dávid Hatvani*, Sándor Ricz*, Ákos Kövér*

* Institute for Nuclear Research, Hungarian Academy of Sciences (MTA Atomki), P.O. Box 51, H-4001 Debrecen, Hungary

† University of Debrecen, H-4032 Debrecen, Hungary

Synopsis Electron spectroscopy is a widely used method for observing the structure and fundamental processes in atomic systems. By employing energy- and angle-resolved photoelectron spectroscopy, valuable information can be obtained about ionization and excitation in photon-atom interactions.

The recently upgraded electron spectrometer, ESA-22D, was developed at the Division of Atomic Physics in Atomki, Debrecen. It was built for precise measurements of energy- and angular-distributions of electrons from the target area. As the spectrometer is cut into two halves we are able to measure two independent electron energy spectra simultaneously, allowing electron-electron coincidence measurements as well.

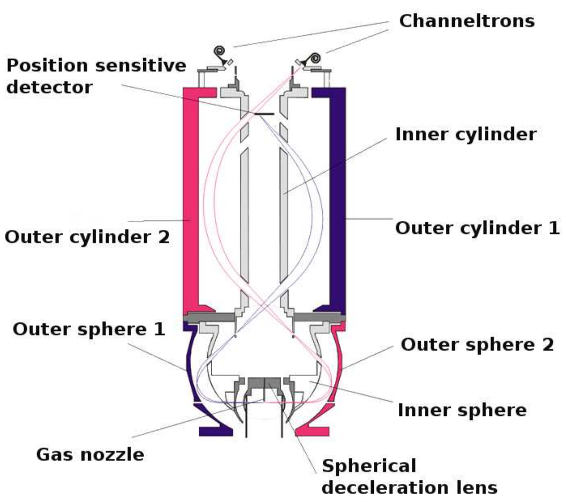

Figure 1. Basic design of ESA-22D electron spectrometer

The most significant improvements from our previous spectrometers [1] are the newly designed UHV vacuum chamber and detector holder, both being rotatable around different axes. Rotating the chamber around the beam axis gives us the opportunity to detect ejected photoelectrons not limited to the collision plane determined by the momentum and polarization vectors of the photons. As a result, our measurements can cover the 3-dimensional space, a unique feat not available before.

24 channel electron multipliers are placed in the holder at every 15°, allowing the simultaneous analysis of high resolution angular distributions. By rotating the holder around the spectrometer axis, the relative efficiencies of the individual detectors, as well as the angle dependent transmission function of the spectrometer can be determined. By summing the obtained intensities, measurement time is greatly reduced.

Furthermore, an electron gun was installed along the spectrometer axis, thus calibration can be performed at every electron energy using the elastically scattered electrons. A new data-gathering and -processing software was also developed using LabView, easing the control and evaluation of measurements.

With our measuring system we plan to study multi-photon single ionization of valence and inner shells of free atoms and molecules at the attosecond beamline being built in Szeged (ELI-ALPS) in order to investigate the channel interaction between the direct and indirect multi-photon ionization processes. We hope to resolve the disagreement between the theoretical end experimental data. We also plan to carry out measurements at the beamline of PETRAIII, Hamburg in order to measure the second order non-dipole contribution in a photon energy range where the dipole and first order non-dipole matrix elements have minimum.

This work was supported by the OTKA (Grant No. K104409).

References

[1] Ricz S., Kövér Á., Jurvansuu M., Varga D., Molnár J., and Aksela S., Phys. Rev **A65** (2002) 042707

[1]E-mail: abrok.levente@atomki.mta.hu