

펨토초 레이저에 의해 문턱너머 이온화 과정에서
발생하는 광전자의 분광분석

Spectrometric Analysis of Photoelectrons Generated in
Above-Threshold Ionization Process Using Femtosecond Laser
Pulse

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The photoelectron angular distribution measurements are presented including electro-static lenses, delay-line position sensitive detector and reconstruction methods used for data analysis. The electro-static lenses and delay-line position sensitive detector were installed to obtain good spatial resolution. For the reconstruction, Fourier-Henkel, onion peeling and iterative methods were used and compared with their relative merits. Using a high power Ti:Sapphire femtosecond laser as the ionization driver, we successfully measured the angular distribution of photoelectrons produced in the above-threshold ionization process in xenon gas.

Experimental setup is shown in Fig. 1. Effusive gas beam is collimated by a skimmer. Base pressure of the target chamber is about 10^{-9} torr. The Electro-static lenses are consist of 3 electrodes, repeller, extractor and ground. Its outer diameter are about 7cm. Extractor and Ground have 2cm-hole. Theses electro-static lense make it possible to focus the particles ionized at the different position into the position sensitive detector. It focal length is determined by the voltage ratio between repeller and extractor. We could get the clean VMI when Voltage ratio between repeller and extractor is 1/0.7.

Figure 2 shows the result of Xe ATI PAD. Radius of angular patterns corresponding to one laser photon energy, 1.53eV. Angular patterns of different radius correspond to photoelectrons generated with different number of laser photons absorbed. [1]

The experimental processes could be applied for the time-resolved molecular dynamics study in Auger decay processes or auto-ionization processes.

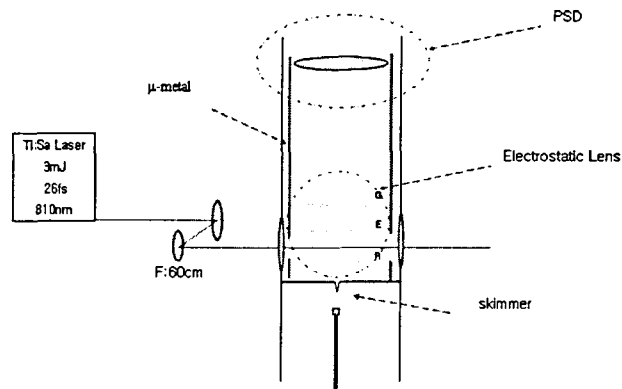


Fig. 1. Experimental setup for PAD measurement.

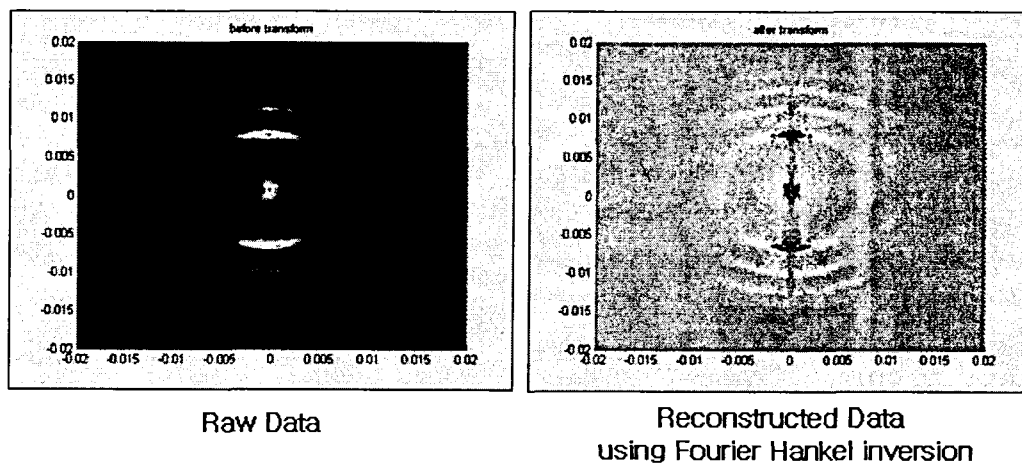


Fig. 2. Photoelectron angular distribution of Xe ATI spectra.

Reference

- [1] V. Schyja, T. Lang and H. Helm, "Channel switching in above-threshold ionization of xenon," *Phys. Rev. A* **57**, 3692-3697 (1998)