4 - 2 A Femtosecond Laser System used for Atomic Physics Research

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A Ti:sapphire femtosecond laser system for atomic physics research has been installed at IMP. The laser system was developed by the Institute of Physics of CAS. It consists a femtosecond Ti:sapphire oscillator seed, a pulse stretcher, a regenerative amplifier and a pulse compressor. The regenerative amplifier was pumped by a Nd:YAG laser with the 10 Hz repetiation frequency. The centre wavelength of this fs laser is 780 nm and the pulse width is about 60 fs (FWHM). The maxium pulse energy is 7 mJ.

A test experiment combining the fs laser system and the COTRIMS experimental setup has been performed. This laser system can run stably for several hours for experimental measuring. The laser beam with 500 μJ pulse energy was fouced on argon target by a lens with 300 mm foucal length. Fig. 1 shows the time-of-flight spectrum, and Ar^+, Ar_2^+ and Ar_2^+ were observed. A two-dimension momentum distribution of Ar_2^+ along the laser polarization was shown in Fig. 2.

In the future, the femtosecond laser system will also be used for Laser-induced breakdown spectroscopy research.

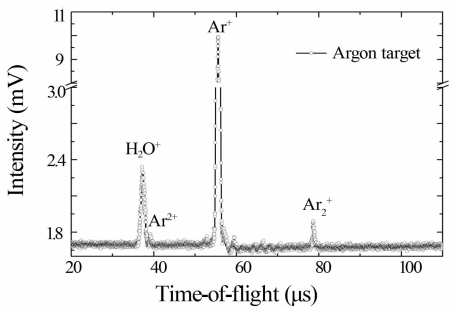

Fig. 1 Time-of-flight spectrum of argon ionized by femtosecond laser.

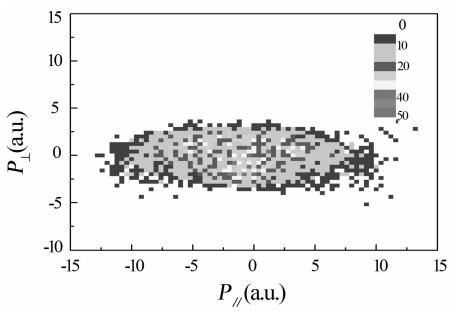

Fig. 2 Ion momentum distribution of Ar^{2+} along the laser polarization.

4 - 3 Rapid Detection of Chromium in Capsule by LIBS Analysis Technique

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Chromium-contaminated capsules events produced a tremendous impact on society in China 2012. However, the traditional methord such as graphite furnace atomic absorption spectrometry must spend long period to detect the Cr element in capsules and is not suitable for rapied detection.

In this work, we want to establish a methord for rapid detection of elements, especially for chromium, in capsules by laser-induced breakdown spectroscopy (LIBS) analysis technique. A double-pulse LIBS system was used here. One laser beam was used for ablation capsules to produce plasma and another laser was used to enhance the plasma spectrum with a several hundreds nanoseconds delay. The elements in capsules can be identified rapidly by analyzing the plasma spectra using a spectrometer. Morever, there was no special need to prepare the capsule samples and the analysis could be finished in serveral seconds. Fig. 1 shows the picture of the capsules after laser ablation. It can be found that the capsule nearly lossless. Our experimental results also show that Cr I (357.34 nm) line is a good choice for chromium element analysis. In our experiments, 19 kinds capsule were analyzed and Cr lines were found in 11 samples. The spectra of three capsule samples in the range of 356～428 nm were shown in Fig. 2. Thereinto, chromium content in F sample was 7 ppm calibrated by atomic absorption methord. It can be decuced that the limit of detection