IMAGING TECHNIQUE TO MEASURE IONIZATION RATE OF ATOMS AS A FUNCTION OF INTENSITY IN A FEMTO-SECOND LASER FIELD

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In the last few years, several experiments have been conducted to study the ionization rate of atoms and molecules in a femto-second laser field. In these studies, the laser is usually focused in an interaction volume which can be defined by a gas cell or a supersonic jet, and the intensity of the laser at the focal point is assumed to be equal to the average intensity of the laser. This assumption remains valid if the Rayleigh length of the focused laser is on the same order of the interaction volume. In the other cases, these studies suffer from a large uncertainty in laser intensity since ions created in the waist of the laser beam are extracted along with ions created outside the waist.

Using an imaging technique based on a longitudinal extraction of the ionized atoms, the ionization rate of atoms in a femto-second laser field is here measured as a function of the laser intensity along the beam waist. A 2-dimensional position-sensitive detector gives the ionization rate, R, as a function of x and y, while the time-of-flight gives the corresponding z information. Separate laser beam profile measurements gives the laser intensity, I, as a function of x, y, and z allowing a conversion of the ionization rate R(x, y, z) into R(I). Thus, for one input laser power, a single 3-dimensional image yields R(I) over a range of I. In this poster, we will describe the basic experimental technique to measure ionization rates in the laser interaction region as a function of laser intensity using a femto-second laser to ionize rubidium vapor.

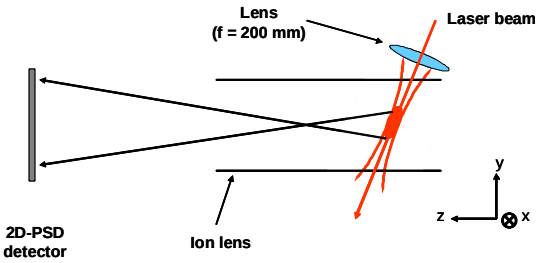

Figure 1: Schematic of the experimental setup. The femto-second laser beam is focussed inside the chamber by a 200 mm focal length lens. The ionized atoms are extracted by an ion lens system and detected with a 2-dimensional position sensitive detector (2D-PSD)

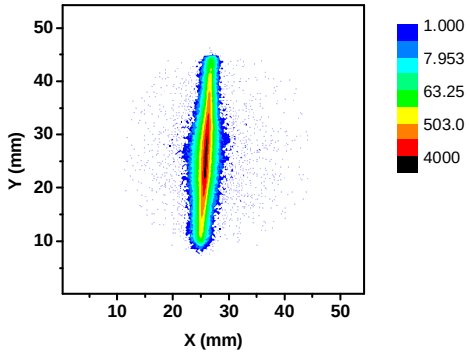

Figure 2: Typical recoil ion detector image.

*Supported by the Chemical Sciences, Geosciences and Biosciences Division, Office of Basic Energy Sciences, Office of Science, U. S. Department of Energy

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