Abstract Submitted
for the DAMOP05 Meeting of
The American Physical Society

X-ray probes of strong field processes in atoms L. YOUNG, R.W. DUNFORD, D.L. EDERER, E.P. KANTER, B. KRAESSIG, J. RUDATI, S.H. SOUTHWORTH, E.C. LANDAHL, D. ARMS, E.M. DUFRESNE, Argonne National Laboratory — Ultrafast laser-X-ray pump-probe experiments will be a major thrust area for the next generation light sources. The shorter pulselength of the X-rays, 200 fs compared to the current 100 ps at APS, will enable probing of ultrafast transient phenomena initiated by, for example, a high power, ultrafast laser. At zero time delay, there will be substantial modification of the spectrum of the sample due to the presence of the laser. We are measuring this modification in the near threshold spectrum of a well-characterized sample (in our case, gas phase krypton atoms) in the presence of the laser over field strengths of 10^{10} - 10^{14} W/cm^2. Technical developments have made it possible to place 40% of the available x-ray flux ($\sim$1 million x rays/pulse) within a 10 micron spot contained within a $\sim$100 micron laser focus. At an intensity of $\sim$2 x 10^{14} W/cm^2, krypton ionization is saturated and we have obtained a complete near-edge spectrum of singly-ionized Kr. Coulomb expansion of the laser-produced ion assembly has been studied both with x-ray in/x-ray out techniques and charged particle detection. X-ray in/x-ray out techniques offer a distinct advantage when probing primary processes since charged particle detectors are sensitive to secondary collisions whereas x-ray emission occurs on the femtosecond timescale.

Linda Young
Argonne National Laboratory

Date submitted: 01 Feb 2005 Electronic form version 1.4