

TIME-RESOLVED EXTREME ULTRAVIOLET SPECTROSCOPY – OPPORTUNITIES FOR SOLAR ENERGY RESEARCH ?

Isabell Thomann, Henry C. Kapteyn, Margaret M. Murnane

*JILA and Department of Physics, University of Colorado
Boulder, CO 80309-0440*

Email address: isabell.thomann@colorado.edu

Attosecond (10^{-18} s) and femtosecond (10^{-15} s) duration pulses can be applied to study electron and nuclear dynamics in atoms, molecules and condensed matter through time-resolved measurements, as well as possibly to control physical processes on these timescales.

We first present the generation of 470 attosecond extreme ultraviolet (EUV) bursts under an intensity envelope of 1.4 femtoseconds, as a suitable tool for studying processes occurring on the attosecond to femtosecond time scale. Second, we present a COLTRIMS (Cold Target Recoil Ion Momentum Spectroscopy) apparatus, which allows reconstruction of the full momentum vectors of all charged particles resulting from an ionization event. Here, molecules from a molecular supersonic gas jet are photoionized by visible femtosecond laser pulses and/or EUV (~ 30 - 250 eV) attosecond to femtosecond pulses. The ions and electrons created in this photoreaction are then detected in coincidence by time- and position-sensitive ion and electron detectors. The presented methods could be used e.g. for the investigation of charge transfer dynamics in metal-containing complexes using visible/ultraviolet femtosecond excitation and delayed EUV ionization.

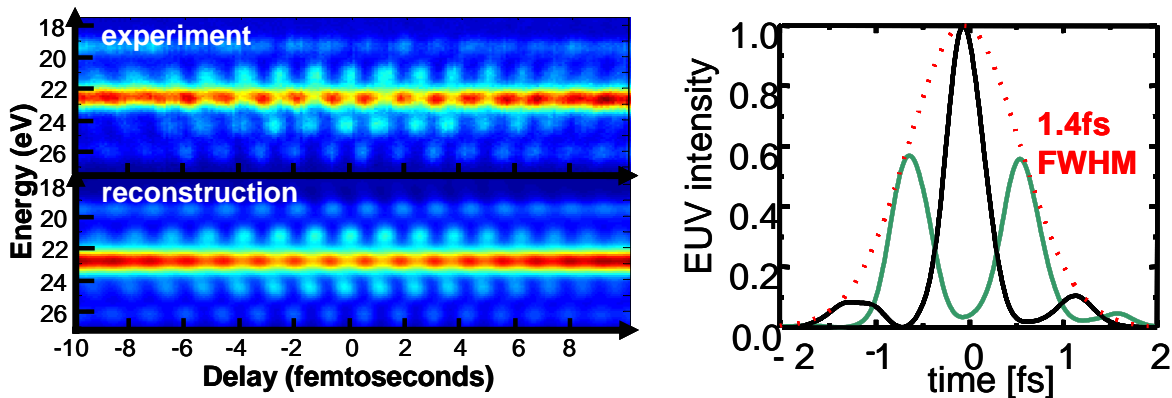


Fig. 1: Upper Left: Photoelectron spectrogram (counts as a function of energy and delay between EUV and infrared pulse) used to temporally characterize the EUV pulse. Photoelectrons are recorded with a magnetic bottle time-of-flight spectrometer. Lower left: Reconstruction, from which the EUV pulse parameters are extracted. Right: EUV pulse intensity versus time reconstructed from data in the left figure [I. Thomann et al, PRA **78**, 1(R) (2008)].

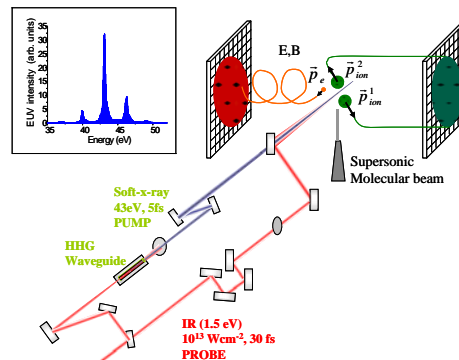


Fig. 2: Coltrims setup [E. Gagnon et al, Rev. Sci. Inst. **79**, 063102 (2008); Science **317**, 1374 (2007); I. Thomann et al, to be published in JPC].