

The COLTRIMS Collaboration at the Advanced Light Source

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I will give an overview of the COLTRIMS collaboration at the Advanced Light Source that is comprised of groups from four institutions: Lawrence Berkeley National Laboratory, University of Frankfurt, Kansas State University, and Auburn University. We perform experiments two times per year when the synchrotron operates in “two-bunch” mode. We measure a variety of basic processes in atomic and molecular physics that are triggered by the absorption of a photon from the ALS by a gas-phase atom or molecule.

After providing a background on the experimental technique, I will present a particular example experiment on the continuum correlation in the core-photoionization of Ne. I will then conclude with a brief overview of some of other recent studies. These include:

- Photo-electron diffraction of fixed-in-space molecules
- Isomerization of C₂H₂ on a femtosecond time scale
- Two-slit and asymmetry effects in double photoionization of H₂
- Core-hole localization in N₂

Sample Publications:

- 1. A two-electron double slit experiment: interference and entanglement in photo double ionization of H₂** D. Akoury, K. Kreidi, T. Jahnke, Th. Weber, A. Staudte, M. Schöffler, N. Neumann, J. Titze, L. Ph. H. Schmidt, A. Czasch, O. Jagutzki, R.A. Costa Fraga, R. Grisenti, R. Diez Muino, N. Cherepkov, S. Semenov, P. Ranitovic, C.L. Cocke, T. Osipov, H. Adaniya, M.H. Prior, A. Belkacem, A. L. Landers, H. Schmidt-Böcking, and R. Dörner (accepted to Science as of September 2007).
- 2. Complete Photo-Fragmentation of the Deuterium Molecule** Th. Weber, A. Czasch, O. Jagutzki, V. Mergel, A. Kheifets, E. Rotenberg, G. Meigs, M.H. Prior, S. Daveau, A.L. Landers, C.L. Cocke, T. Osipov, H. Schmidt-Böcking, R. Dörner, Nature **431**, 437 - 440 (2004).
- 3. Auger electron molecular frame angular distributions as a probe for molecular structure** T. Jahnke, J. Titze, L. Foucar, R. Wallauer, T. Osipov, E.P. Benis, A. Alnaser, O. Jagutzki, W. Arnold, L. Ph. H. Schmidt, A. Czasch, M. S. Schöffler, Th. Weber, A. L. Landers, A. Belkacem, C. L. Cocke, M. H. Prior, H. Schmidt-Böcking, and R. Dörner (Phys. Rev. Lett., submitted).
- 4. Single Photon-Induced Symmetry Breaking of H₂ Dissociation** F. Martín, J. Fernández, T. Havermeier, L. Foucar, Th. Weber, K. Kreidi, M. Schöffler, L. Schmidt, T. Jahnke, O. Jagutzki, A. Czasch, E. P. Benis, T. Osipov, A. L. Landers, A. Belkacem, M. H. Prior, H. Schmidt-Böcking, C. L. Cocke, R. Dörner, Science **315**, 629 (2007).
- 5. Photon-Ion Collisions and Molecular Clocks** T. Osipov, A.S. Alnaser, S. Voss, M.H. Prior, T. Weber, O. Jagutzki, L. Schmidt, H. Schmidt-Böcking, R. Dörner, A. L. Landers, E. Wells, B. Shan, C. Maharjan, B. Ullrich, P. Ranitovic, X.M. Tong, C.D. Lin and C.L. Cocke, J. Modern Optics, **52**, 439 (2005).
- 6. Photoelectron-photoion momentum spectroscopy as a clock for chemical rearrangements: Isomerization of the dication of acetylene to the vinylidene configuration** T. Osipov, C. L. Cocke, M. H. Prior, A. Landers, T. Weber, O. Jagutzki, L. Schmidt, H. Schmidt-Böcking and R. Dörner, Phys. Rev. Lett. **90** 233002 (2003).
- 7. Multicoincidence studies of photo and Auger electrons from fixed-in-space molecules using the COLTRIMS technique** T. Jahnke, Th. Weber, T. Osipov, A.L. Landers, O. Jagutzki, L.Ph.H. Schmidt, C.L. Cocke, M.H. Prior, H. Schmidt-Böcking, R. Dörner, J. Elect. Spect., **141** 229–238 (2004).
- 8. Photoelectron Diffraction Mapping: Molecules Illuminated from Within** A.L. Landers, Th. Weber, I. Ali, A. Cassimi, M. Hattass, O. Jagutzki, A. Nauert, T. Osipov, A. Staudte, M.H. Prior, H. Schmidt-Böcking, C. L. Cocke and R.Dörner, Phys Rev. Lett. **87**, 013002 (2001).