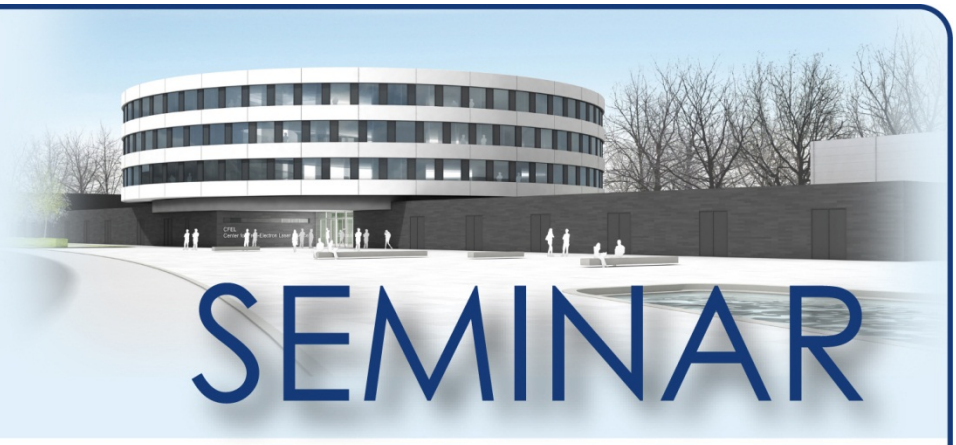
CFEL SCIENCE



SEMINAR

12th May 2011 - 10:15

Building 25f, Room 456

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Molecular frame Photoelectron angular distributions from EUV/X-ray ionization of aligned molecules

Following ultrafast chemical reactions, both in time and space, is a main objective in the field of chemical physics. Novel ultrashort EUV/X-ray laser sources like high harmonic generation and free electron laser combined with laser induced alignment technique, make it possible to develop new techniques toward this goal. These new approaches are based on the measurement of the molecular frame photoelectron angular distributions (MFPADs). Photoelectrons ejected by XUV ionization from a molecule contains information about the molecular orbitals from which they are removed. In addition, the outgoing electrons experience the surrounding atoms in the molecule as scattering centers, endowing the photoelectron angular distribution (PAD) with a sensitivity to the underlying molecular structure [1]. The extraction of detailed information about orbitals and/or structure is only possible if the PAD is measured in the molecular frame. This challenge can be met by using molecular alignment and orientation techniques [2-3] that allow one to control the angular distribution of a parent molecule before the ionization event takes place. Here, we present first results for the ionization of aligned CO_2 molecules using femtosecond EUV pulses from a HHG source and using X-ray pulses from LCLS, the free electron laser of Stanford. The MFPAD is shown to contain informations about the orbital symmetries of the ionization channels that are accessed and the onset of an interference/diffraction pattern related to the molecular field, and consequently, the molecular structure. A comparison with quantum calculations will be shown as well.

[1] Landers, A., et al., Physical Review Letters, 87, 013002, (2001).

[2] Stapelfeldt, H. and T. Seideman, Reviews of Modern Physics, 75, 543, (2003).

[3] Ghafur, O., et al., Nature Physics, 5, 289, (2009).

Host: Jochen Küpper - Coherent Imaging Division - Controlled Molecule Imaging Group