CFEL SCIENCE

SEMINAR

17th November 2011 - 10:00
Building 49, Seminar Room (108)

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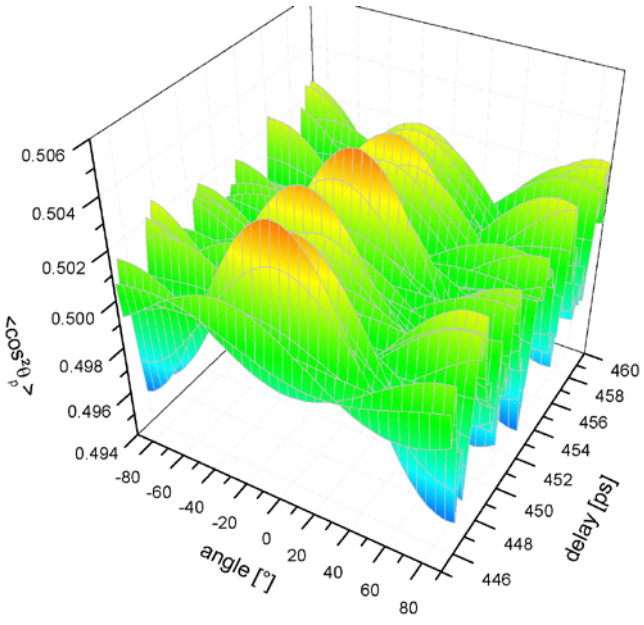
Ultrafast dynamics in prototypical molecular systems and clusters

We present our recent results obtained at FLASH covering a broad spectral range from nonlinear soft X-ray interaction with clusters to microwave spectroscopy in the time domain on cold CO molecules. We show that fluorescence spectroscopy in combination with simultaneously recorded time-of-flight mass spectra reveals new information on energy deposition, charge migration and recombination processes of rare gas clusters in the light of FLASH.



The focus of the presentation is on the coherent superposition of two rotational quantum states of carbon monoxide excited in a non-resonant Raman process using near-infrared fs laser pulses. The associated “wave packet motion” is followed in time by subsequent Coulomb explosion at FLASH. The coupling of J=0 and J=2 states results in an asymmetry of spatial fragmentation patterns detected parallel to the laser polarization axis. The time-dependent asymmetry oscillation prevails for at least 1 ns covering more than 300 revivals without noticeable decoherence.

This observation can serve as a new route for real-time disentanglement of intra- and intermolecular rotational couplings, which occur in complex systems and environments. Our conclusions are supported by a fully quantum mechanical model. The approach pushes the time resolution of present microwave spectroscopy toward the ultimate limit given solely by the rotational period of the molecule.

Host: Jochen Küpper, CFEL Molecular Physics Seminar