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New Perspectives for Time Resolved Chemistry Using High Harmonic Generation and Free Electron Lasers

Monitoring nuclear and electron motion during chemical bond formation and change will greatly advance our understanding of chemical reactions.

I will present two approaches for this task: One is related to ultrafast x-ray spectroscopy at the newly built LCLS (Linac Coherent Light Source) and I will briefly present experimental concepts at this machine. The second approach uses strong field high harmonic generation (HHG), which will constitute the main part of the talk. The HHG process is sensitive to electronic orbitals on Angstrom length scale and sub-femtosecond time scale. I will introduce the basics of HHG and discuss HHG spectra recorded on argon and molecular nitrogen targets. In the case of argon I will show how the strong laser field shifts the Cooper minimum. In N₂ we have found experimental evidence that, in addition to the highest occupied molecular orbital, a more deeply bound orbital also contributes to HHG. This breaks a common paradigm in HHG and opens the opportunity to study interesting chemistry related to the breakdown of the Born-Oppenheimer approximation.

CV

November 5, 2009

Time: 4:00pm

Location: Brace 211

Refreshments: 3:30pm, Brace 201