ICFO COLLOQUIUM JENS BIEGERT 'Lightwave Driven Quantum Dynamics: From Molecular Movies to Bloch Waves'

JENS BIEGERT

December 04, 2018

Tuesday, December 4, 2018, 12:00. ICFO Auditorium

JENS BIEGERT

ICREA Professor, Attoscience and Ultrafast Optics research group at ICFO$$Jens Biegert is ICREA professor at ICFO and heads the Attoscience and Ultrafast Optics group. He received his PhD from the Technical University Munich in 2001 and led research on ultrafast pulse generation and strong field physics during his Habilitation at ETH Zurich from 2001 until 2006. Since 2007 at ICFO, his research focus lies on the investigation of the real-time quantum dynamics of electrons and nuclei in atoms, molecules and solids. This research employs home-built cutting-edge laser technology, attosecond soft x-ray pulses and electron

diffraction for atomic-scale imaging of molecular dynamics and to unravel the interplay between carriers and the lattice in quantum solids. He holds an appointment as adjunct professor at the University of New Mexico in the USA, is associate editor of APL Photonics, a fellow of the German Academic Scholarship Foundation and the Optical Society of America, recipient of the OSA Allen Price and ERC Advanced Grant holder.
Electron recollision in an intense laser field gives rise to a variety of phenomena, ranging from electron diffraction to coherent soft X-ray emission. We have, over the years, developed intense sources of waveform-controlled mid-IR light to exploit the process with respect to ponderomotive scaling, quantum diffusion and quasi-static photoemission. I will describe how we leverage these aspects to "teach" molecules to take a selfie while undergoing structural change. This permits visualizing for the first time, with combined attosecond temporal and atomic spatial resolution, molecular bond breaking and deprotonation. Furthermore, we achieve isolated attosecond pulses in the soft X-ray water window across the oxygen edge at 534 eV. Accomplishing ultrafast temporal resolution in combination with the soft X-ray?s element specificity now provides an entirely new view on the combined electronic and nuclear dynamics in real time. I will show first results in which we resolve the carrier dynamics in a quantum material in real time and within the material?s unit cell.

These results provide first comprehensive insight into the dynamics of molecules and condensed matter, with the future possibility to address fundamental and long-standing questions such as molecular isomerization, phase transitions and superconductivity.

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