CFEL SCIENCE

SEMINAR

8th April 2021 - 10:00 h

Zoom virtual meeting https://desy.zoom.us/j/91202137161

(Meeting-ID: 912 0213 7161, Password: 845021)

Pascal Salières

Lasers Interactions & Dynamics Laboratory, ATTOLab, CEA-Saclay, France

Revealing photoionization dynamics using attosecond spectroscopy

The generation of attosecond light pulses has opened the possibility to track the fastest dynamics in matter, in particular the electron dynamics that naturally occur on such a short timescale. Attosecond spectroscopy is thus able to shed new light on fundamental electronic processes involved in a variety of physical, chemical and biological reactions. A recent example is photo-electron emission for which attosecond delays between photon absorption and electron emission are becoming measurable in rare gas atoms, molecules or solids. When ionization occurs in the vicinity of a resonance, the dynamics is strongly perturbed and cannot be simply characterized by a group delay.

In a recent series of experiments, we were able to reconstruct the full ionization dynamics in structured continua by performing an advanced characterization (spectral amplitude and phase) of the released electron wavepackets (EWP), using a spectrally resolved electron interferometry technique called Rainbow RABBIT. This allows reconstructing complete autoionization dynamics including the resonance buildup, and evidences how photoelectron wavepackets are born and morph into asymmetric Fano profiles [1,2]. During this seminar, I will review the recent studies performed at CEA-Saclay, with a special emphasis on two cases. First, the technique was used to disentangle the overlapping contributions of different subshells, and to access their relative ionization delays in regions of Cooper minima involving intershell correlation [3]. Second, the question of the coherence in photoionization experiments will be addressed with a quantum state tomography of the EWP that provides a measurement of decoherence due to entanglement with unobserved degrees of freedom [4].

[1] Gruson V *et al* 2016 *Science* 354 6313
[2] Barreau L *et al* 2019 *Phys. Rev. Lett.* 122, 253203
[3] Alexandridi C. *et al* 2021 *Phys. Rev. Research*, in print
[4] Bourassin-Bouchet C *et al* 2020 *Phys. Rev. X* 10, 031048

Hosts: Francesca Calegari / CFEL Molecular and Ultrafast Science Seminar