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# SEMINAR

**29th April 2021 - 10:00 h** Zoom virtual meeting

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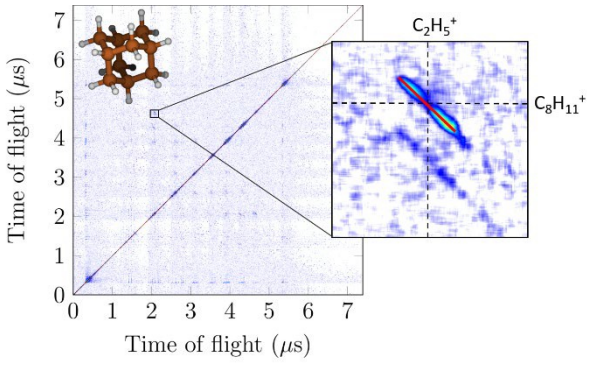
## Dynamics in atoms and molecules studied using intense attosecond pulses

The ultrafast dynamics of ionized and excited molecular systems depend on fundamental processes such as charge transfer and migration [1], leading to chemical reactions and dissociation through, for instance, intramolecular rearrangements. To achieve a deeper knowledge of the interplay between charge and structural dynamics in molecules, it is necessary to simultaneously probe the dynamics in the molecule on femtosecond and attosecond timescales, as these are the ones on which nuclear motion and charge dynamics occur, respectively. Currently, the main route to reach such short time-scales is to use High-order Harmonic Generation (HHG), in which an intense infrared (IR) femtosecond pulse is focused in a gas, leading to the generation of odd harmonics of the driving field in the extreme ultraviolet (XUV) region and pulse durations in the attosecond regime.




While attosecond charge migration experiments so far have been based on two-color XUV-pump IR-probe approaches [2], an alternative approach is to do XUV-pump XUV-probe experiments. These are challenging since the XUV pulses have to be sufficiently intense to allow the absorption of two or more XUV photons. Such experiments have previously been limited to free electron lasers, but in the last decade intense HHG sources reaching pulse energies in the microjoule range have been developed which are uniquely suited to extend the studies of multiple ionization/excitation dynamics using XUV light on the sub-femtosecond timescale.

In this seminar, I will give an overview of the activities at the Lund Attosecond Science Center, focusing on the developments at the High-Intensity Attosecond Beamline [3], including its specifications and experimental possibilities as well as an outlook regarding our ongoing developments towards time-resolved measurements. In particular, I will present our recent experimental results from photo-dissociation of the simplest diamondoid, adamantane ($C_{10}H_{16}$), which plays an important role in astrophysics and biology [4].


[1] L. S. Cederbaum, et al., Chem. Phys. Lett. 307, 205 (1999); F. Remacle, et al., Proc. Natl. Acad. Sci. 103, 6793(2006);
[2] F. Calegari, et al., Science 346, 336 (2014); M. Lara-Astiaso, et al., J. Phys. Chem. Lett. 9, 4570(2018)
[3] B. Manschwetus, et al., Phys. Rev. A 93, 061402 (2016).
[4] S. Maclot, et al., Scientific Reports 10, 2884 (2020)


**Host: Melanie Schnell / CFEL Molecular and Ultrafast Science Seminar**