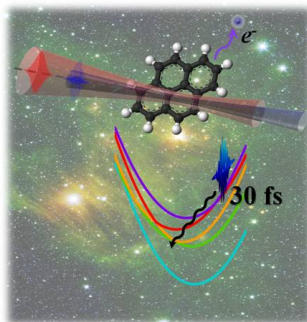


**Laboratory :** Institute of light and matter (iLM)  
**Research Team :** Structure and multi-scales dynamics of complex molecules ([web](#))  
**Supervision :** Marius Hervé (PhD student), Saikat Nandi (CNRS), Vincent Loriot (UCBL) & Franck Lépine (CNRS)  
**Contact :** [franck.lepine@univ-lyon1.fr](mailto:franck.lepine@univ-lyon1.fr)



*For Master 2 student - Year 2018-2019*

## **New types of laboratory XUV ultrafast science experiments to unravel molecular processes in space**

The generation of ultrashort and intense laser pulses (Physics Nobel Prize 2018) allows controlling ultrashort VUV and XUV pulses in the femtosecond ( $1 \text{ fs} = 10^{-15} \text{ s}$ ) down to the attosecond ( $1 \text{ as} = 10^{-18} \text{ s}$ ) timescale which has opened new avenues in photo-physics, chemistry and biology by making accessible the observation of dynamics at such ultrashort timescales<sup>1,2</sup>. In space, molecules are constantly excited by energetic photons that sculpt the molecular composition of the universe. However, the lack of information on how complex molecules react to such excitation, limits the development of an accurate molecular evolution scenario.

The group “Multiscale dynamics in molecular structure” at iLM has pioneered the use of ultrashort XUV pulses to perform time-resolved experiments on molecules of astrophysical interests such as polycyclic aromatic hydrocarbons (PAH). The first ever experiment of that kind has been recently performed by our group<sup>3</sup> and has driven a lot of interest in the scientific community worldwide.

In this project, the student will address the question of how the XUV excitation proceeds in PAH and pre-biotic small biomolecules. He/she will use the iLM XUV beamline to perform pump-probe experiments that give access to energy relaxation and photoinduced pathways. This experimental work is developed in close collaboration with astrophysicists and theoreticians.

We seek for a highly motivated Master 2 student interested in ultrafast science and interdisciplinary research. Feel free to contact us for further information.

**Possibility for PhD Thesis: YES**

<sup>1</sup> Attosecond molecular dynamics: fact or fiction? F. Lépine et al. Nature Photonics 8, 195–204 (2014)

<sup>2</sup> Attosecond Molecular dynamics, Lépine and M. Vrakking, Royal Society of chemistry, Book (2018)

<sup>3</sup> XUV excitation followed by ultrafast non-adiabatic relaxation in PAH molecules as a femto-astrochemistry experiment, A. Maciniak et al. Nature Communications volume 6, 7909 (2015)