Spécialité de Master « Optique, Matière, Paris »

Stage de recherche (4 mois minimum, à partir de début mars)

Proposition de stage (ne pas dépasser 1 page)

Date de la proposition : 24 octobre 2017

Responsable du stage / *internship supervisor*:

Nom / *name*:	CHARRON	Prénom/ *first name* :	ERIC
Tél :	01 69 15 61 14	Fax :	-
Courriel / *mail*:	eric.charron@u-psud.fr		

Nom du Laboratoire / *laboratory name*: ISMO – Institut des Sciences Moléculaires d'Orsay

Code d'identification : UMR 8214 Organisme : CNRS / Université Paris-Sud

Site Internet / *web site*: www.ismo.u-psud.fr

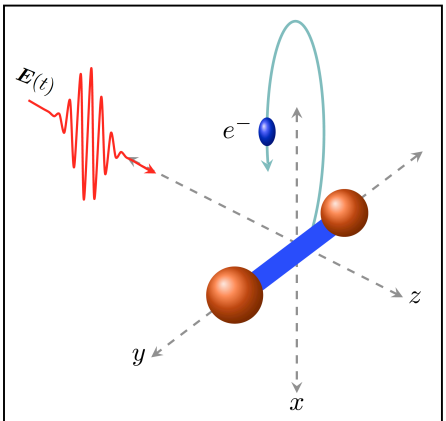
Adresse / *address:* Bâtiment 520 – Université Paris-Sud – 91405 ORSAY cedex

Lieu du stage / *internship place*: ISMO, Bâtiment 520, Université Paris-Sud

Titre du stage / *internship title*: **MOLECULAR ORBITAL IMAGING BY LASER INDUCED ELECTRON DIFFRACTION**

Résumé / *summary*

Unlike in the linear regime of light-matter interaction, the response of an atom or a molecule to an intense external field depends profoundly on the field parameters. When an intense infrared field is applied to an atom or a molecule, it distorts the system by forming a potential barrier through which a bound electron can tunnel out. The subsequent dynamics of the laser-driven electron wave packet in the continuum can be described by the so-called three-step mechanism: After its release in the continuum, the electron, following the field, will scatter from the ionic core. This process is known as "*recollision*" and the particular case of elastic recollision is popularly known as "*laser-induced electron diffraction*", or LIED.



Schematic view of the recollision process

We have recently demonstrated that this laser-induced diffraction process can be used to study the dynamics of molecular systems and to access structural information about molecules [1,2]. We have specifically shown that it is possible to invert the diffraction patterns of LIED photoelectron spectra and to reconstruct an image of the initial molecular orbital of the system within the assumption that the motion of the nuclei is frozen.

In this internship, we propose to study the influence of the nuclear dynamics on this reconstruction procedure. This theoretical study will concentrate on model systems, such as the single-electron and the two-electron molecules H_2^+ and H_2. The Master student will perform time-dependent numerical simulations of the electronic and nuclear dynamics of these systems in intense laser fields, and will use analytical approaches based on the strong-field approximation for the molecular orbital reconstruction procedure. It is expected that this study will clarify the limits of applicability of this reconstruction procedure in a more realistic experimental context.

[1] R. Puthumpally-Joseph, J. Viau-Trudel, M. Peters, T. T. Nguyen-Dang, O. Atabek, and E. Charron
Inversion of strong-field photoelectron spectra for molecular orbital imaging
Physical Review A **94**, 023421 (2016). doi:10.1103/PhysRevA.94.023421 or arXiv:1607.02273

[2] R. Puthumpally-Joseph, J. Viau-Trudel, M. Peters, T. T. Nguyen-Dang, O. Atabek and E. Charron
Laser-induced electron diffraction: Inversion of photoelectron spectra for molecular orbital imaging
Molecular Physics **115**, 1889 (2017). doi:10.1080/00268976.2017.1290837 or arXiv:1610.08232

Toutes les rubriques ci-dessous doivent obligatoirement être remplies

Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* **? : Yes**

Si oui, financement de thèse envisagé/ *financial support for the PhD*:
Fellowship from the EDOM PhD School

Lumière, Matière, Interactions	**X**	Lasers, Optique, Matière	**X**

*Fiche à transmettre (fichier pdf **obligatoirement**) sur le site http://stages.master-omp.fr*