

Master 2: *International Centre for Fundamental Physics*

INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: Institut des Sciences Moléculaires d'Orsay (ISMO)
CNRS identification code: UMR 8214
Internship director's surname: Goldsztejn
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Web page: <http://www.ismo.universite-paris-saclay.fr/spip.php?article2364>
Internship location: ISMO

Thesis possibility after internship: YES/NO
Funding already obtained for a PhD: YES/NO If YES, which type of funding:

Title: Ultrafast dynamics in models of biomolecules

Biomolecules are complex systems in which many electronic excitation and relaxation pathways coexist after absorption of a photon. These electronic transitions can have ultrashort lifetimes (in the order of few femtoseconds, i.e. 10⁻¹⁵ s) and are, thus, extremely difficult to evidence and interpret experimentally.

During this internship, we will focus on charge transfer processes, i.e. after photoexcitation one electron localized on an atom is transferred to a neighboring atom of the molecule. This type of mechanism is crucial in a wealth of areas ranging from photovoltaic applications to the most elementary biological or biochemical processes.

In order to study this process, we will use a new methodology based on the measurement of Auger electrons which are localized on a metallic heteroatom, in a porphyrin-like molecule, which will serve as a local probe of electronic rearrangement subsequent to photoabsorption. The main advantage of Auger spectroscopy is that the detected electron carries information on the matrix elements involving both the electronic excitation and relaxation: it allows to determine the excited electronic state of the molecule as well as the final state reached.

This internship combines experimental and theoretical work and can therefore adapt itself to the student's scientific profile. The PhD that may arise after intends to study the fundamental physical processes involved in photodynamic therapy which is an alternative to surgery or chemotherapy for treating cancers and is based on the photoexcitation of porphyrin-like molecules. The PhD will be done on several experimental setups going from laboratory IR and UV lasers to large facilities such as Xray free electron lasers and synchrotron facilities and in close collaboration with chemists and researchers of biomedical domains.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: ~~YES~~/NO Soft Matter and Biological Physics: YES/~~NO~~
Quantum Physics: YES/~~NO~~ Theoretical Physics: ~~YES~~/NO