

MASTER IN PHOTONICS – PHOTONICS BCN EUROPHOTONICS-POESII MASTER COURSE

PROPOSAL FOR A MASTER THESIS

Dates: April - September 2017

Laboratory : ICFO
Institution: ICFO
City, Country : Spain

Title of the master thesis: Attosecond x-ray transient dynamics

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Summary of the subject (maximum 1 page) :

The advent of femtosecond laser spectroscopy made it possible to observe atomic motions on a time scale that is shorter than a single vibrational period in molecular systems, giving birth to the field of Femtochemistry, for which A.H. Zewail received the Nobel Prize in Chemistry in 1999. In traditional Femtochemistry, time-resolved studies are performed by two femtosecond optical lasers, making possible to follow in “real-time” molecular and biochemical reactions, phase transitions or coherent oscillations in solids, opening immense insight in our understanding of light-induced phenomena in matter. Nowadays, we have the laser technology to produce attosecond pulses, those short durations open the door to track the fastest motion in molecules: the motion of electrons.

The need to visualize molecular and electronic structure in the course of a chemical reaction has been the dream of scientists for decades. The development of time-resolved x-ray methods is making this true. Nowadays it is possible to generate attosecond x-ray pulses as short as only 300 as. It is essential to be able to simulate, explore, and understand state-of-the-art x-ray experiments. Development of corresponding theoretical and computational tools will have high impact. Our goal is to perform the most insightful research that combines theory with experiment. The student will learn attosecond physics, quantum chemistry, and inner-shell physics, get involved with computational techniques, and help in the development of theoretical approaches to describe x-ray transient absorption spectra.

Keywords : attosecond physics, molecular coherent dynamics, laser and x-ray spectroscopy, computational methods

Additional information :

* Required skills :

* Miscellaneous :