



PHOTONICS - EUROPHOTONICS MASTER COURSE

MASTER THESIS PROPOSAL

Course 2014 –2015

Laboratory: Ultrafast Optical Dynamics of Solids @ ICFO

City, Country: Castelldefels (Barcelona), Spain

Title of the master thesis: Measuring real-time femtosecond dynamics in materials

Name and affiliation of the tutor of the master thesis : Simon Wall

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Summary of the subject (maximum 1 page):

The interactions between electrons, the lattice and spins of a system are some of the most fundamental processes that determine a material's properties. Understanding these processes allow us to understand why materials have the properties they do, and how we can manipulate them.

One way to investigate these couplings is to use lasers to excite electrons on a timescale shorter than their coupling to other degrees of freedom (typical <50 fs). How these electrons lose their energy can then be "watched" as it evolves.

Currently the pump-probe technique has been very successful at observing dynamics in materials which relax back to their initial state on short timescales, but fails when light is used to change the state of the material and the system recovers to a different state than it started in. However, these irreversible changes, such as light-induced magnetization reversal and phase transitions represent very important material processes.

The Masters project will investigate and compare several alternative methods to measure such dynamics and evaluate their limits of validity using numerical simulations of the signals. A successful and motivated candidate will then be able to implement a scheme in the lab.

Keywords : Optics, Femtosecond, Lasers, Material Science, Condensed Matter Physics, Numerical Techniques.

Additional information :

* Amount of the monthly allowance (if it is the case): €300

* Required skills: Excellent knowledge of Optics, good ability with programming (Ideally python) and ability to numerically solve equations and work independently. Lab experience with femtosecond lasers would be ideal but not necessary.