EUROPHOTONICS-POESII MASTER COURSE

PROPOSAL FOR A MASTER THESIS

Dates: April 1st, 2016 – September 30th, 2016

Laboratory : ICFO – The Institute of Photonic Sciences
City, Country : Barcelona, Spain

Title of the master thesis: Manipulating and detecting light at the nano-scale in novel graphene and two-dimensional materials

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Summary of the subject (maximum 1 page) :
Manipulating and detecting light at lengthscales of just a few nanometers will enable extraodinary new capabilities such as nano-optical circuitry, biological sensing, optical transistors, nano-lasers etc. etc.
This project aims at exploring the novel opto-electronic properties in graphene and related 2-dimensional materials. These materials were first fabricated and characterized in 2004 by Geim and Novoselov (Nobel Prize in Physics in 2010) and not all of its properties have yet been investigated and understood.
During the Master Thesis we will focus on developing, fabricating and characterizing novel kind of photodetectors made out of different 2-dimensional materials. The student will be involved in the fabrication of the devices, their mechanical and electrical characterization and optical measurements. Mechanical characterization include atomic force microscopy (AFM) and optical measurements include ultrafast scanning photocurrent microscopy, photoluminescence spectroscopy, and scanning near-field microscopy (SNOM).

References:
Photodetectors based on graphene, other two-dimensional materials and hybrid systems
F. H. L. Koppens, T. Mueller, Ph. Avouris, A. C. Ferrari, M. S. Vitiello, M. Polini
Nature Nanotechnol. 9, 780-793 (2014)

Highly confined low-loss plasmons in graphene–boron nitride heterostructures
A. Woessner, M. B. Lundeberg, Y. Gao, A. Principi, P. Alonso-González, M. Carrega, K. Watanabe, T. Taniguchi, G. Vignale, M. Polini, J. Hone, R. Hillenbrand, F. H. L. Koppens
Nature Materials, 14, 421-425 (2015)

Picosecond photoresponse in van der Waals heterostructures
M. Massicotte, P. Schmidt, F. Vialla, K. G. Schädler, A. Reserbat-Plantey, K. Watanabe, T. Taniguchi, K. J. Tielrooij and F. H. L. Koppens
Nature Nanotechnology, in press (2015).

Keywords : Opto-electronics, Graphene, 2-dimensional materials, photodetectors

Additional information :
* Required skills : Physics or electronics background; preferably but not necessarily with profound knowledge in solid state physics and optics
* Miscellaneous :