# MASTER IN PHOTONICS – "PHOTONICS BCN"
# ERASMUS+ "EUROPHOTONICS-POESII"

## MASTER THESIS PROPOSAL

### Dates: April  - September 2018

**Laboratory : Nano-optoelectronics**
**Institution: ICFO – The institute of photonic sciences**
**City, Country : Barcelona (Castelldefels)**

**Title of the master thesis:**
**Nano-photonic graphene-based infrared photodetectors**

**Name of the master thesis supervisor:**
**Prof. Frank Koppens, Sebastian Castilla, Dr. Seyoon Kim**

Email address : frank.koppens@icfo.eu
Phone number : +34 93 553 4002

**Keywords :** graphene, photodetectors, plasmonics, nanophotonics, antennas

## Summary of the subject:

Graphene-based photodetectors have been proposed as an alternative for current technologies due to its broadband absorption properties ranging from visible, infrared and terahertz range. In this project, we will focus on the photo thermoelectric effect which drives the photocurrent in our graphene p-n junction devices for infrared light [1].

The goal of the project is to enhance the infrared photoresponse by introducing concepts from nanophotonics. For example, by placing optical nano-antennas or by exploiting plasmons inside the graphene [2,3]. The student will design new device concepts, simulate them and is involved in the experimental process in collaboration with other group members.

The student will work inside a team and will use current state-of-art tools for determining the optical response of the photodetector such as Lumerical FDTD and Comsol. Afterwards, once obtained the optical response, it will be used as an input for the calculation of the thermoelectric response using Comsol and Python. The student will take advantage of previous work performed by the group in this field [4].
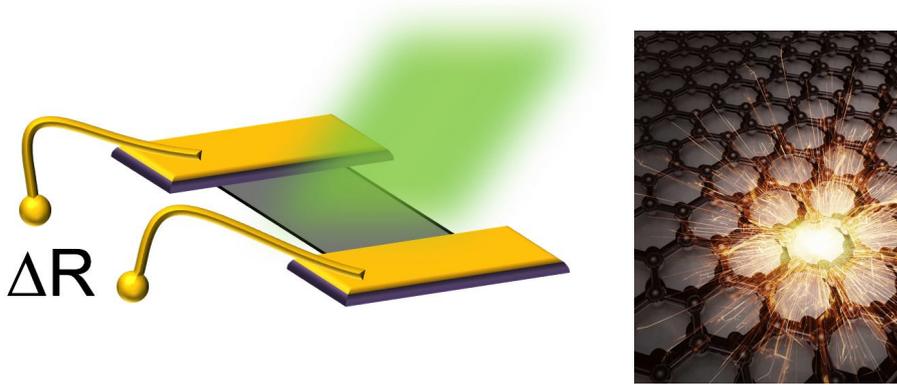
References
[1] Koppens et al., *Nature Nanotech*. **9**, 780 (2014)
[2] Low et al., *Nature Materials* **16**, 182 (2017)
[3] Kim et al. *Phys Rev. B* **90**, 165409 (2014)
[4] Kim et al. *Nature Nano*. **12**, 770-775 (2017)

**Additional information :**
* Required skills : knowledge in optics and condensed matter physics, computational skills
* Miscellaneous :