



## **MASTER IN PHOTONICS – “PHOTONICS BCN” ERASMUS+ “EUROPHOTONICS-POESII”**

### **MASTER THESIS PROPOSAL**

**Dates: April - September 2018**

**Laboratory : Ultrafast Dynamics of Quantum Solids**

**Institution: ICFO**

**City, Country : Barcelona, Spain**

**Title of the master thesis: X-ray holography as a tool for nanoscale X-ray spectroscopy**

**Name of the master thesis supervisor:**

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**Keywords : Holography, Correlated materials, X-rays, imaging, spectroscopy, nanoscale**

**Summary of the subject (maximum 1 page) :**

X-ray holography is a powerful imaging technique that enables imaging of samples with nanometre resolution without the need to use any lenses. To do this, the technique makes use of interference between coherent X-rays. X-rays that travel through the sample diffract causing amplitude and phase shifts in intensity. This diffracted beam is interfered with light from a reference beam producing a hologram which is recorded on a CCD camera. The Fourier transform of the hologram can then be computed to give a real space image of the sample. This is highly advantageous in the soft X-ray region because lenses in this wavelength range are very challenging to construct.

One disadvantage of this technique is that a filter is normally used in order to increase the sensitivity of the camera. This filter is applied in Fourier space and acts to remove the DC intensity in the image. As a result, holographic images are very sensitive to differences within a sample, but do not give reliable information on the absolute transmission of the sample. This DC component is often key for identifying a specific material property, particularly when the sample is not well known.

This project will investigate how the DC contribution can be added to holographic images. The masters project will have two directions. One direction will involve numerical simulations of the effects of different filters on the images obtained by X-ray holography. The other aspect will be to use real data, measured by our group, to correct for the lost DC term. Both directions will consist of numerical/computational work only.

The student should have a good background in programming, numerical skills and a good understanding of Fourier transforms.

**Additional information :**

- \* Required skills :
- \* Miscellaneous :