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## Master in Photonics – “PHOTONICS BCN” ERASMUS+ “EUROPHOTONICS”

### MASTER THESIS PROPOSAL

**Dates: April - September 2021**

**Laboratory :** Attoscience and Ultrafast Optics

**Institution:** ICFO

**City, Country :** Castelldefels, Spain

**Title of the master thesis:** Samples and theory for attosecond x-ray physics.

**Name of the master thesis supervisor:** Prof. Dr. Jens Biegert

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**Keywords :** attosecond science, condensed phase physics, spectroscopy

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

In the Attoscience and Ultrafast Optics group at ICFO we study light-matter interactions in condensed matter systems on ultrafast attosecond time-scales. Our table-top beamline is capable of generating isolated soft x-ray attosecond pulses via high-harmonic generation. Such ultrashort soft x-ray pulses give access to study electronic and lattice dynamics in solids after the excitation with a strong optical field. The element specific absorption of x-rays and their short wavelength require samples of high structural quality.

This project focusses on the preparation and theoretical investigation of solid samples for attosecond soft x-ray spectroscopy. You will use density functional theory to calculate properties such as band structure and state resolved properties to understand how the material may respond to optical excitation. Further you will learn how to use an ultramicrotome to prepare nano-meter thin samples for characterization with an optical setup which you will build. Important aspects are the absorption, the damage threshold and information on material excitation.