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The Institute  
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## **Master in Photonics – “PHOTONICS BCN” Master ERASMUS Mundus “EuroPhotonics”**

### **MASTER THESIS PROPOSAL**

**Dates: April 2021 - September 2022**

**Laboratory:**

**Institution: Mapsi Photonics**

**City, Country: Cornellà de Llobregat, Barcelona**

**Title of the master thesis: Mid-Long Infrared band-pass 3D photonic crystal filter optimization with TMM techniques**

**Name of the master thesis supervisor and co-supervisor: David Cardador**

(for external proposals a co-supervisor from the Master program is needed)

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**Keywords: Mid-Long infrared, 3D Photonic Crystal, Transfer Matrix Method, Spectroscopic Sensor**

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

Emerging applications such as thermography, medical diagnostics and gas detection are becoming increasingly popular as technology evolves. All infrared filter manufacturers use the so-called multilayer technique to manufacture them. That is, they deposit multiple layers of different materials and grow on top of each other to block, reject or transmit specific wavelength ranges. This manufacturing process is highly optimized for applications in the visible, near infrared or even short infrared. However, in the Mid Infrared (MIR) and even more in the Long Infrared (LIR), some technical drawbacks appear, such as adhesion problems between layers, exotic materials to be used or too wide layers, which affect the figures of merit of optical filters, degrading them a lot.

But can you imagine making a totally different filtering using only silicon instead of multilayers? Well, that's what we do at Mapsi Photonics! We drill holes in a silicon wafer and, by controlling the shape of these holes or pores, we can block, reflect or transmit better than a multilayer filter.... with a single material!

We have several demonstrators in the MIR and LIR ranges and we want to optimize them to achieve excellence in our products. To do this, we need to test different shapes of our



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nanostructures and evaluate the pros and cons of each of them, and for this task we need you! Would you like to join a small but dynamic and growing team? We need someone with knowledge about photonic crystals (or who wants to learn fast about them), who has a creative mind to visualize the problem in a broad perspective to find the right solution, who has some python programming skills and, most importantly, who is passionate and highly motivated to face the challenges.

At the end of this Master Thesis you will have performed a comprehensive study on macroporous silicon photonic crystals applied to infrared sensing. These results will be implemented and tested in our laboratories during or immediately after your work. We are looking for someone who can also continue with us for further research on the topic, who knows if in an industrial Ph.D. Would you like to join us? We look forward to your contact!

**Additional information (if needed):**

- \* Required skills: Knowledge of optics and physics, Programming (Python/C++) and Motivation!
- \* Miscellaneous: experience in nanofabrication or chemistry.