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## **Master in Photonics – “PHOTONICS BCN” Master ERASMUS+ “EuroPhotonics”**

### **MASTER THESIS PROPOSAL**

**Dates: April 2021 - September 2022**

**Laboratory: Department of Electronics and Biomedical Engineering**

**Institution: Universitat de Barcelona (UB)**

**City, Country: Barcelona, Spain**

**Title of the master thesis: Experimental characterization of interacting pairs of Silicon-based optomechanical crystals**

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

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**Keywords:** Cavity Optomechanics, silicon, optomechanical crystals

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

Cavity optomechanics, highlighted by the prestigious journal Nature as one of the latest milestones in photonics, studies the interaction between electromagnetic and mechanical modes in optical resonators. Among the different possible realisations of optomechanical cavities, optomechanical crystals (OMCs) are probably those with the strongest potential from the technological point of view since they can be straightforwardly integrated in photonic integrated circuit platforms. As a consequence of the periodic variation of both the dielectric and elastic properties, OMCs behave at the same time as photonic and phononic crystals, thus being able to display both photonic and phononic energy gaps of forbidden energies. By carefully introducing engineered defects within the periodical structure it is possible to create photonic/phononic cavities leading to the comparison of spatially colocalized photonic and phononic states within the gaps with enhanced light/matter interaction.

The master student will be integrated into an on-going national project dedicated to the implementation of OMCs in silicon chips that operate at room temperature in the near IR optical region, with applications in data processing or sensing, among others. In particular, the student will be in charge of the basic experimental characterization of coupled pairs of optomechanical oscillators.

References (<http://navarrourrios.com/Publications.html>):

D. Navarro-Urrios et al., “Nonlinear dynamics and chaos in an optomechanical beam”, Nature Communications, 8, 14965 doi:10.1038/ncomms14965 (2017).



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D. Navarro-Urrios et al., "Properties of Nanocrystalline Silicon Probed by Optomechanics", *Nanophotonics*, 9(16), 4819-4829 (2020)

M. F. Colombano et al. "Synchronization of Optomechanical Nanobeams by Mechanical Interaction", *Physical Review Letters* 123 (1), 017402 (2019). Featured in [Physics.aps.org](http://Physics.aps.org), see Synopsis: Synchronizing Nanosized "Pendulums"

**Additional information (if needed):**

\* Required skills: Some knowledge of waveguide and fibre optic operation is recommended. The work will be primarily experimental, so good skills and interest in doing laboratory work is also recommended.

\* Miscellaneous :