



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 microsphere optomechanical cavities coupled to silicon nitride photonic waveguides

Name of the master thesis supervisor and co-supervisor:

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Keywords: Cavity Optomechanics, microsphere resonators, silicon nitride, optical waveguides

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 (OM) cavities, circular resonators have probably been the most studied so far. However, an important drawback when studying these systems concerns their optical integration in photonic chips. In this project, the master student will study microspherical OM resonators and their possible integration with a silicon nitride based photonic platform containing optical waveguides. The latter will allow the optical excitation of the resonator and the collection of the output signal. The student will perform an experimental characterisation of the photonic systems on a two-step process:

- 1) A basic experimental characterisation of the OM resonators using an optical tapered fiber for optical excitation and detection and a test of the optical transmission of the silicon nitride waveguides within the photonic platform.
- 2) A study of the coupled system composed of the spherical OM resonators coupled to the silicon nitride waveguides



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

M. F. Colombano, G. Arregui, F. Bonell, N. E. Capuj, E. Chavez-Angel, A. Pitanti, S.O. Valenzuela, C. M. Sotomayor-Torres, D. Navarro-Urrios, M. V. Costache, "Ferromagnetic resonance assisted optomechanical magnetometer", Physical Review Letters, 125, 147201 (2020)

A. Toncelli, N. E. Capuj, B. Garrido, M. Sledzinska, C. M. Sotomayor-Torres, A. Tredicucci, and D. Navarro-Urrios, "Mechanical oscillations in lasing microspheres", Journal of Applied Physics, 122, 053101 (2017); doi: <http://dx.doi.org/10.1063/1.4997182>

J. M. Ramirez, D. Navarro-Urrios, N. E. Capuj, Y. Berencen, A. Pitanti, B. Garrido and A. Tredicucci, "Far-field characterization of the thermal dynamics in lasing microspheres", Scientific Reports 5, 14452; doi: [10.1038/srep14452](https://doi.org/10.1038/srep14452) (2015).

D. Navarro-Urrios, J. M. Ramirez, N. E. Capuj, Y. Berencen, B. Garrido and A. Tredicucci, "Vertical coupling of laser glass microspheres to buried silicon nitride ellipses and waveguide", Journal of Applied Physics, 118, 093103 (2015)

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 :