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ICFO
The Institute
of Photonic
Sciences



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

MASTER THESIS PROPOSAL

Dates: April 2021 - September 2021

Laboratory: Semiconductor laser lab, Dynamics Nonlinear Optics and Lasers (DONLL)

Institution: Universitat Politècnica de Catalunya

City, Country: Terrassa, Barcelona, Spain

Title of the master thesis: Experimental control of laser-generated speckle patterns

Name of the master thesis supervisor and co-supervisor: Cristina Masoller, Jordi Tiana

Email address: cristina.masoller@upc.edu

Phone number: 34690757830

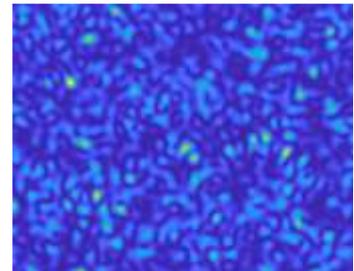
Mail address: Rambla St. Nebridi 22, Terrassa 08222

Keywords: diode lasers; semiconductor lasers; speckle; machine learning

Summary of the subject (maximum 1 page):

Diode lasers are popular light sources for imaging because they are low-cost, emit a stable output, and cover a wide range of wavelengths. However, illumination with coherent diode laser light produces a spatial interference pattern, known as a speckle pattern (shown in the fig.), which is detrimental for the image quality. On the other hand, speckle contains useful information about the spectral properties of the light and of the scattering medium that generates the speckle.

We have recently shown that the speckle contrast can be minimized (which is desirable for imaging applications) or maximized (which is desirable for applications that extract information from speckle patterns) by tuning the pump current of the laser and the settings of the image acquisition system.



The goal of the TFM is to test whether current modulation and optical feedback from an external mirror can be used to control the degree of coherence of the light emitted by the diode laser, thus allowing to further increase or decrease the amount of speckle. The TFM requires experimental work in our lab, which is doable in present COVID crises because we have a large, well-equipped and well-ventilated lab, where only one or two persons work simultaneously.

[1] D. Halpaap, J. Tiana-Alsina, M. Vilaseca, C. Masoller, “*Experimental characterization of the speckle pattern at the output of a multimode optical fiber*”, Opt. Express 27, 27738 (2019).

[2] D. Halpaap et al., “*Experimental study of speckle patterns generated by low-coherence semiconductor laser light*”, Chaos 30, 063147 (2020).

Additional information (if needed):

* Required skills: Matlab, labview, programming skills are desirable but not mandatory.

* Miscellaneous: A scholarship is possible depending on the skills of the candidate.