

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: Implementation of an optical attenuator and a motorized linear stage for the optimization of the generated speckle pattern at the output of an optical fiber.

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Keywords: diode lasers; optical chaos; symbolic analysis; machine learning

Summary of the subject (maximum 1 page): Diode lasers with optical feedback from an external mirror can emit a chaotic output, depending on the experimental physical parameters. The emitted chaotic signals have found several applications, including all-optical random number generation [1]. The complexity of the optical signal can be tuned by controlling different experimental parameters such as feedback strength, external cavity length, and laser pump current.

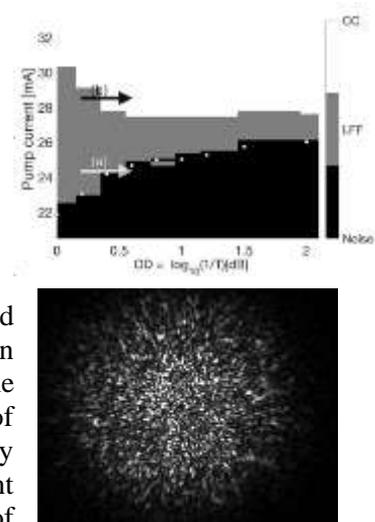
The goal of the TFM is to implement experimentally an optical attenuator and a micrometric linear stage both remotely controllable in order to find the most suitable experimental parameters (i.e. feedback strength and external cavity length) which optimize the speckle contrast. Speckle is an interference pattern generated when a diffusive surface is illuminated. The first figure shows an experimental map representing the occurrence of different dynamical regimes (noisy intensity fluctuations, low frequency fluctuations, and coherence collapse) in the parameter space (laser current in mA, feedback strength) [2]. The second figure shows an example of speckle pattern from the output of a multimode optical fibre [3].

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] M. Sciamanna and K. A. Shore, “Physics and applications of laser diode chaos”, Nature Photonics 9, 151 (2015).

[2] M. Panozzo, C. Quintero-Quiroz, J. Tiana-Alsina, M. C. Torrent, and C. Masoller “Experimental characterization of the transition to coherence collapse in a semiconductor laser with optical feedback”, Chaos 27, 114315 (2017)

[3] 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).



Additional information (if needed):

* Required skills: Matlab, Labview and python are desirable but not mandatory.

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