



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

MASTER THESIS PROPOSAL

Starting full time from April 2024

Presentation at the end of July or beginning of September 2024

Laboratory: Instituto Universitario de Investigación en Óptica y Nanofísica

Institution: Universidad de Murcia

City, Country: Murcia, Spain

Title of the master thesis: Characterization and Manipulation of Photon Bunching for Biomedical Applications

Name of the master thesis supervisor and co-supervisor: Enrique Josua Fernandez and Crina Cojocaru

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

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Keywords: Pseudo-thermal light sources, bunching, intensity interferometry, non-linear microscopy

Summary of the subject (maximum 1 page):

The n^{th} -order or n^{th} -degree of coherence function provides information about the instantaneous intensity correlation across n spatial points at n temporal points. The thermal light sources present a second order coherence function with a maximum value of 2. This fact is also referred to as the Hanbury Brown-Twiss effect. A possible interpretation of this value is that photons arrive most likely in pairs to a given point and time within the coherence volume. Photon bunching -how photons are emitted, transmitted, and detected in terms of packing- is directly related to the coherence function. Certain experimental techniques allow the manipulation of the photon bunching, generating sources with thermal characteristics out of a laser source, or even augmenting the value of the bunching (superbunching).

By acting over the bunching of the illumination employed in non-linear microscopy it is expected a benefit in terms of efficiency in the technique.



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Objectives:

Understand and implement a technique to characterize the bunching of light sources.

Use light sources of distinct bunching to measure and characterize the effects of this illumination in non-linear microscopy, with special emphasis on biological samples.

Additional information (if needed):

* Required skills:

* Miscellaneous: