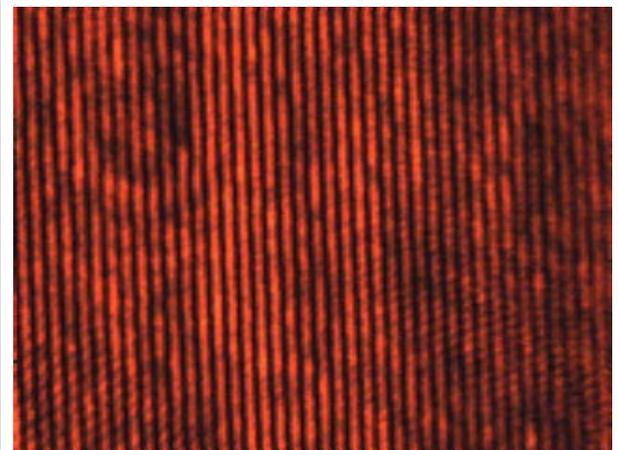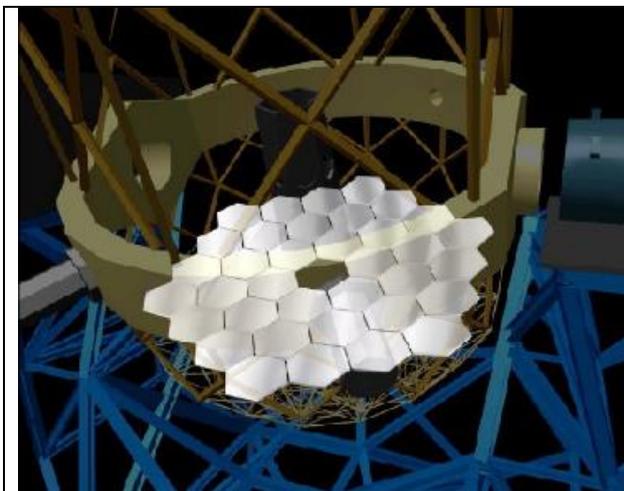# PHOTONICS - EUROPHOTONICS MASTER COURSE

PROPOSAL FOR A MASTER THESIS

Dates: February 1st, 2022 – September 10th, 2022

Laboratory: Centre for Sensors, Instrumentation and systems Development (UPC-CD6)
City, Country: Terrassa, Spain

Title of the master thesis:

IMPLEMENTATION OF AN EDGE-COMPUTING SYSTEM FOR REAL-TIME FRINGE PROCESSING

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Mail address: Rambla Sant Nebridi 10 E08222 Terrassa

Summary of the subject (maximum 1 page):

Which is the problem?
At CD6 we are developing the phasing system of the Extremely Large Telescope, to ben installed in Atacama, Chile. Our Tasks involve the development of an interferometric system enabling to measure the relative position of the segment sof the primary mirror of the telescope, which need frequent maintenance. A large dynamic range, medium resolution interferometer is being built with this purpose.

One of the requirements of the telescope is to be able to process fringes at an extremely fast frame rate (1 image per second for the complete calculation of piston, tip and tilt). The calculations are performed in a dedicated NVIDIA Jetson TX2 edge-computer, which is the responsible of all the calculations to be performed in the unit. This includes testing different types of algorithms, implementing the edge computing system, and exploring the optimal computational approach. Parallelization of the image processing using the GPU in the computer will be an essential part of the task. An experimental setup is ready and fringe patterns for processing are already available.

What will you do?
You will join our research group, where you'll have support on the use of edge computers for fringe processing, and on software developments base don CUDA (parallelization). This project aims to explore the implementation of an edge computing system for fringe processing based on a white-light interferometer. The interested student will work in a combination of experimental and fringe processing tasks with the goals of

1) Achieving the measurement of the desired magnitudes (piston, tip,tilt) out of the measured interferograms, selecting the better processing procedures (including ghost removal, calibration, and computation of values).
2) Implementing the processing, initially performed in Matlab, on an edge computer with several GPUs.
3) Finally, to optimize the performance of the algorithms in order to be as fast as possible without affecting the accuracy of the units, either by choosing different types of algorithms or calibration strategies, and/or by dividing computational loads between the GPUs of the computer.

This is a combined experimental/programming Thesis. Programming skills (Python, C, CUDA) are recommended and will be used as criteria for the selection of the candidate.

Keywords: fringe processing, parallelization, image processing, interferometry, metrology

Additional information :
* Amount of the monthly allowance (if it is the case):
To be discussed depending on the value of candidate.

* Required skills:
Interest in application-driven experimental work for solving real-world problems.
Basic concepts in optical metrology and optical engineering
Programming (C++ desirable, Python or proficiency in Matlab minimum) and use of scientific software packages (Labview...)

Search of resources, both scientific and technical
Self-motivated, objective-driven, capable of autonomous working within a multidisciplinary team.

* Miscellaneous:
This thesis contents will be considered <u>confidential</u> due to its closeness to market.
International team with several years of experience in the topic proposed.
Multidisciplinary environment with electronics and mechanics workshops, and specialists and technicians in metrology, optics, mechatronics, and electronics.
Possibility of joining the Centre for a PhD/Project Manager career in case of common interest.
<u>Early incorporation welcome</u>.