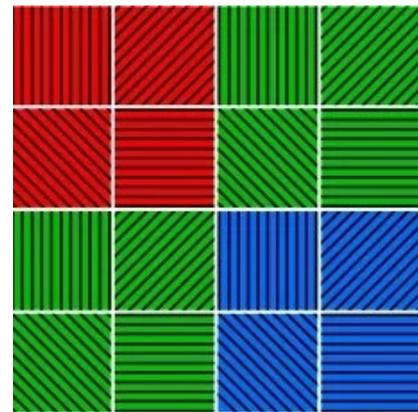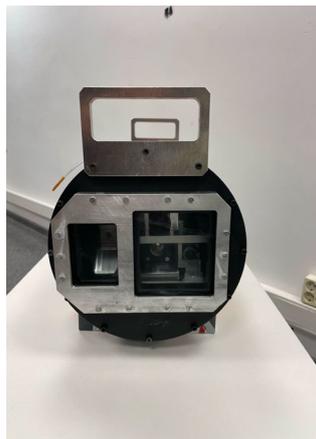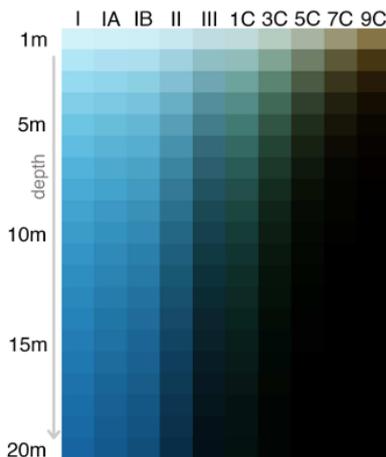# PHOTONICS - EUROPHOTONICS MASTER COURSE
PROPOSAL FOR A MASTER THESIS

Dates: February 1st, 2026 – September 30th, 2026

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

Title of the master thesis:

LiDAR AND POLARIMETRIC IMAGING FOR VISION THROUGH UNDERWATER TURBID MEDIA

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Summary of the subject (maximum 1 page):

Underwater visibility strongly depends on light scattering and absorption, which vary with water turbidity and particle concentration. These effects limit the performance of underwater imaging and perception systems. Polarimetric imaging offers a promising way to mitigate scattering effects and improve contrast, since it allows separating the light reflected by objects from the background haze caused by suspended particles.

This thesis will focus primarily on experimentally assessing how different polarimetric imaging modes affect underwater visibility under controlled turbidity conditions. Using a polarimetric camera and an underwater LiDAR system, the student will perform a series of tests in water tanks with varying levels of suspended particles. Visibility metrics—such as contrast, resolution and target detectability—will be evaluated using standardized test patterns (e.g. USAF resolution charts) under different polarization configurations (e.g. co-polarized, cross-polarized, DoLP analysis).

A secondary objective is to analyze how the measured changes in visibility relate to the optical attenuation properties of the medium, and to explore whether these measurements can be used to infer basic water-type parameters (e.g. Jerlov classification) through simplified radiative models.

The project combines experimental optics, imaging, and data analysis. The student will join an experienced research group in underwater sensing and optical instrumentation, and will receive guidance in experimental design, calibration, and interpretation of results.

This project is ideal for students interested in applied optics, imaging, and environmental monitoring. Experience in Python or Matlab will be helpful for image analysis and visualization.

Keywords: lidar, camera, underwater, attenuation, polarization, datasets, python.

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 (Python minimum, Matlab desirable).
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>.