PHOTONICS - EUROPHOTONICS MASTER COURSE

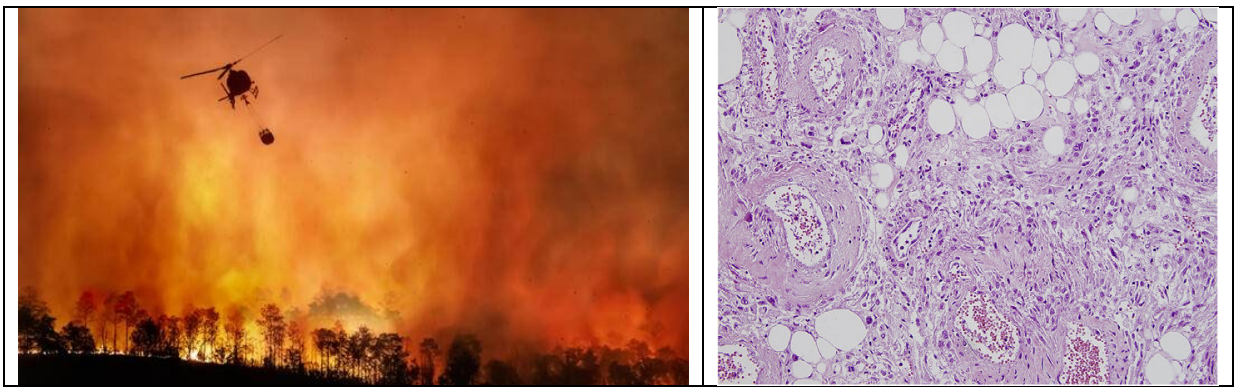
PROPOSAL FOR A MASTER THESIS

Dates: February 1st, 2021 – September 30th, 2021

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

Title of the master thesis:

LIGHT INTERACTION WITH IRREGULAR PARTICLES: MODELING SMOKE



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Summary of the subject (maximum 1 page):

Which is the problem?

Interaction of light with different turbid media is still a field being tackled by many research groups and companies around the world. For example, in outdoor scenarios, imaging systems may become limited by the degradation of atmospheric conditions that partially or totally hampers the detection of light. Applications involving fog, dust, smoke or sand get severely hampered by absorption or scattering phenomena. In the outstanding field of navigation and security (e.g. landing a helicopter in sandstorms), detection under deteriorated vision scenes is a huge unsolved problem. In the field of biomedical optics, different techniques of diagnosis and therapy are based on the interaction of light with tissue, which can be modelled as a turbid media. There are still questions about how light is behaving under these circumstances. A better understanding of the phenomena could help to improve those techniques.

At CD6, a line of research is focused in improving light detection in turbid media using non-standard optical techniques. Characterisation of the interaction of light with a turbid media made of spherical particles (e.g. round blood cells, rain and fog…) is already made. Next step is to explore what happens with irregular particles (e.g. epithelial cells, dust, smoke or sand…).

What will you do?

This project aims 1) to explore how the modelling of light interacting with irregular particles is commonly approached and 2) to identify the method to do it that better suits our interests. The milestone of this project is the implementation of the selected method and its incorporation into an existing light-propagation model. Contribution of ideas on how to validate it and improve it will also be valuable. First of all, a bibliographic revision of the topic is expected. Previous projects have worked in this filed so the information is already quite bounded. Alongside, you will be encouraged to get familiar with the model used for propagating light through regular particles, as well as with the experiments performed in the lab related to this topic. Then, the selected method for irregular particles is expected to be implemented and used in the propagating model. Finally, an interpretation of the results would be necessary in order to assess whether the selected method fulfils the requirements or not.

Keywords: turbid media, irregular particles, T-matrix, Monte-Carlo, light-matter interactions

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++) 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 confidential 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.
Early incorporation welcome.