Master in Photonics – "PHOTONICS BCN"
ERASMUS+ "EUROPHOTONICS"

MASTER THESIS PROPOSAL

Dates: April - September 2020

Laboratory : CommSensLab – Department of Signal Therory and Communications
Institution: Universitat Politècnica de Catalunya
City, Country : Barcelona, Spain

Title of the master thesis: Assessment of a fluorescence lidar for the measurement of pollen in the atmosphere

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Keywords : lidar, laser, spectroscopy, bioaerosols

Summary of the subject (maximum 1 page) :

Lidar (light detection and ranging or laser radar) applies photonics to detect and range a variety of targets and, in particular, atmospheric constituents. By sending a laser pulse to the atmosphere and collecting (with a telescope), detecting (with a photoreceiver) and recording (with a digitizing system) the backscattered radiation originating from different physical processes, range-resolved information about the state of the atmosphere and the presence of particles, droplets, and gases can be retrieved. Detecting the distribution of bioaerosols (biogenic particles suspended in the atmosphere), and in particular of pollen, is of interest in relation with biological processes (e.g. the study of pollination of plants) and their possible effects on human health (e.g. allergies and respiratory diseases). This master thesis aims at assessing the main design characteristics of a future lidar system to be developed by the lidar research group at CommSensLab for the detection of the vertical distribution of pollen released by species of trees common in the Mediterranean basin. The work structure is as follows:

Task 1. Literature survey to collect spectroscopic information related to fluorescence in different types of pollen typical of the Mediterranena basin, e.g. *Pinus*, *Platanus*, etc.

Task 2. Use of the information gathered in point 1 to determine the possible excitation wavelengths (in principle restricted to the 2nd, 3rd and 4th harmonics of the fundamental wavelength of a Nd:YAG laser, respectively at 532 nm, 355 nm and 266 nm), the fluorescence spectra and their relative intensities.

Task 3. With the outputs of task 2, along with information available at the group of the range of pollen grain concentrations to be expected, plus typical characteristics of photomultiplier tubes, interference filters and spectrometers, elaborate signal-to-noise budgets as a function of the excitation pulse wavelength and energy, of the pollen concentration, of the collecting telescope diameter and of the range.

Task 4. Using the output of task 3, proposal of possible configurations of the fluorescence lidar to be developed.

Additional information :

* Required skills : Optic design, Matlab desirable
* Miscellaneous : Engineering-oriented disposition, willingness to work across disciplines.