Université de Lille

Area Cross Disciplinary Project Lille

Aerosol at the heaRt of the Earth/Atmosphere system

Master 2 - Research Training – 01/02 to 30/06/2026

Laboratory: PhysicoChimie des Processus de Combustion et de l'Atmosphère (PC2A) and Laboratoire d'Optique Atmosphérique (LOA)

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AREA Work Package: 1

Laboratory Characterization of Aerosol Fluorescence for Improved Lidar Data Interpretation.

Aerosols play a crucial role in atmospheric processes, influencing climate, air quality, and human health. Understanding their optical properties, especially fluorescence characteristics, is essential for improving remote sensing techniques such as lidar. Fluorescence lidar has emerged as a powerful tool for characterizing aerosol properties, but its interpretation remains challenging due to the complex nature of aerosol fluorescence signatures, which are influenced by particle composition, size, and atmospheric conditions.

This project aims to bridge the gap between laboratory characterization and atmospheric lidar observations by performing controlled fluorescence measurements of aerosols under well-defined conditions. The study will focus on desert dust, bioaerosols and biomass burning aerosols (BBA), using a tunable laser system. These experiments will be performed at the PC2A by using a set-up generating a constant concentration of fine particles in suspension. The flow of particles will be illuminated by a UV-vis light generated by a tunable laser. Fluorescence signals will be recorded by a spectrometer connected to an ICCD camera and photomultiplier. The particle size distribution of the particles will be also recorded in order to link the spectral signature to the concentration and the size of the particles. The results will help to establish a reference database of fluorescence spectra, which will be compared with multispectral fluorescence lidar data obtained from the LOA's LILAS and LIFE systems. By integrating laboratory measurements with real-world lidar observations, this study aims to enhance the reliability of lidar-based atmospheric monitoring and improve the identification of various aerosol sources in different environmental contexts.

The student will gain hands-on experience in optical spectroscopy, aerosol generation and measurement, fluorescence data acquisition, and data analysis. This multidisciplinary research environment will provide valuable insights into atmospheric sciences, remote sensing technologies, and environmental chemistry.

Keywords: Aerosol metrology - Light scattering and absorption – Fluorescence - LIDAR - Atmospheric remote sensing.