

LAPI

Laboratory of Atmospheric Processes and their Impacts

Section Sciences et Ingénierie de l'environnement Design Project 2023 (semestre de printemps)

Proposition n°11

<p style="text-align: center;">Experimental studies with novel instrumentation to measure air pollution</p>
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Partenaire externe ou laboratoire IIE

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AeroSpec (incubating at LAPI, EPFL, under the Innogrant)

Taille de l'entreprise (nbre de collaborateurs) : Incubating startup (2 members)

EPFL ENAC IIE LAPI, Station 2, GR C1 517, 1015 Lausanne

Site Web www.aerospec.ch (under construction)

Encadrant EPFL (proposition facultative qui sera validée par la Section)

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Laboratory of Atmospheric Processes and their Impacts (LAPI), ENAC, IIE

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<https://www.epfl.ch/labs/lapi/>

Descriptif du projet

The project involves working on a novel instrument for performing aerosol chemical composition analysis experiments. The instrument is part of the startup "AeroSpec", where they aim to make chemical composition analysis of aerosol more widespread and adaptable, to allow better particulate matter analysis and policy making. To do this, the infrared aerosol monitor (IR-AM) instrument was have developed as an automated aerosol collector (for PM_{2.5}) that performs IR spectroscopy on the particles and then self-cleans itself. The final aspects of automations are currently underway.

The project involves:

- Designing experiments that would maximize the types and sizes of aerosols analyzed (prior knowledge of aerosol is a plus but not necessary)
- Designing and 3D printing (possible for us to train) any small parts needed to smoothly run the experiment, or to make minor adjustments to the instrument
- Preparing chemical solutions (pure compounds and mixtures) that would be "nebulized" to generate varied sizes and concentrations of aerosol particles
- Using the novel IR-AM instrument to collect the aerosol and manage the data collection, while monitoring the instrument for smooth operation

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- Developing some codes for analyzing the data coherently as there are multiple sources of data (flow, pressure, voltages, and IR spectra) that need to be coherently analyzed
- Analyzing the aerosols collection data with currently available codes to obtain mass concentrations of the different chemical components
- Guidance and assistance will be provided at every step.

Objectif et buts

Objective:

Evaluate the instrument IRAM for collection of different aerosol types and sizes and evaluating the differences and compiling the results and their analysis.

Realistic goals:

- An experimental setup for aerosol collection
- Some python codes for evaluating the results coherently
- A thorough evaluation of the material and size specific measurements of the IR-AM
- Write a report on the findings, compiling the response of the instrument to the various aerosols and scientifically analyzing the results.

Descriptif tâches

- Engineering: Setup the experiment for generating aerosols and evaluating the IRAM
- Lab work: Preparing salt and other mixed solutions to nebulize
- Measurements: Performing experiments, while monitoring the progress
- Computer coding: Developing some codes to ensure coherent and time stamped data collection (data is currently generated from two main separate sources – a control system and the spectrometer)
- Prototyping: Possible 3D printing fabrication if small parts are needed during running of the experiments

Divers

A number of skills have been listed in the different tasks – as all the skills are quite diverse, we are happy to train the students on their desired skills and guide the project at every step.