

PhD Third Year Report

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Summary of scientific activity

During the third year of my PhD, I finished the development and characterization of the BLAnCA instrument. BLAnCA (Broadband Light Analyzer of Complex Aerosol) is now a fully automated instrument for measuring the light absorption characteristics of atmospheric aerosol.

I assembled and started testing the third and final version of the instrument. The new setup was built at the INFN mechanical workshop at DIFI. The final version of the instrument is made up of the following parts: a high power halogen white light source with a roughly black body spectrum peaked around 700 nm; a light guide and a collimating lens of 2 cm of diameter to illuminate the sample under analysis; a 12-position wheel to hold aerosol-loaded filters, to allow automatic measurement of several samples; a rotating arm which moves the detecting fiber optic from 0° (transmission angle) until 165° ; a fiber optic cable which takes the scattered light to a high resolution spectrometer. Additionally, an electric shutter allows the measurement of dark reference spectra. The spectrometer is interfaced with the PC via USB connection, and the instrument operation is automated through a custom LabView virtual instrument. I updated the LabView interface to reflect the changes in hardware, using a state machine concept to handle the added complexity of multiple filter measurements.

I carried out several characterization measurements, in order to understand a) the limit of detection of the instrument, b) the factors contributing to the measurement uncertainty, and c) any systematics present in the setup.

Additionally, I measured aerosol sampled in several conditions. Some types of aerosol were produced and processed during a few experimental campaigns at the atmospheric simulation chamber ChAMBRé, installed at INFN Genoa. Another batch of samples consisted of resuspended desert dust, sampled at LISA - Université Paris Est Créteil. I carried out an atmospheric aerosol sampling campaign with samplers and instruments positioned in Propata, on the Ligurian Appennine mountains, from the beginning of March until the end of April 2024. The aim of this campaign was to obtain real aerosol samples with the characteristic wood burning source profile, for which the Propata site is perfect since it is a small mountain town where the majority of heating is done through wood burning stoves.

Attended courses

- Fisica dell'atmosfera e dispersione di inquinanti (Master's degree course).

Conferences

- Talk at the ACTRIS Science Conference, Rennes (FR), 13-16 May 2024;
- Talk at the national congress of the Italian Aerosol Society, PM2024, Torino, 28-31 May 2024;
- Poster at the International Sopot Youth Conference, (online), 7 June 2024;
- Talk at the European Aerosol Conference, Tampere (FI), 26-30 August 2024;
- Poster at the European Aerosol Conference, Tampere (FI), 26-30 August 2024.

Publications

- T. Isolabella et al., 2024. A new software toolkit for optical apportionment of carbonaceous aerosol, *Atmospheric Measurement Techniques* 17.
- V. Moschos et al., 2024. Quantifying the Light-Absorption Properties and Molecular Composition of Brown Carbon Aerosol from Sub-Saharan African Biomass Combustion, *Environmental Science and Technology* 58.