Aims and Motivation

This project aims to develop an algorithm for the classification of particles based on their scattering patterns for a range of aerosols, such as mineral dust, fungal spores, ice crystals, mineral fibres, and liquid droplets.

Using Machine Learning as done in other relating research on particle classification

Support Vector Machine (SVM)

- Aspect ration predictions (1) - Estimating PAD (SVR)
- Estimating prism sizes (SVC)
- Aspect ration predictions (SVM)

Random Forest Classifier

- Predicting prism orientation
- Piecewise criteria will be tricky to implement because it will require some form of pre-classification

Neural Network (NN)

- Predicting prism orientation
- Piecewise criteria will be tricky to implement because it will require some form of pre-classification

Based on existing work classifying real and modelled particles.

Thematic Broadening Sabbatical (TBS)

Project:

Implement a Convolutional Neural Network (CNN) auto encoder on time series fluorescence data to determine how to optimise minimising losses between training and test data

Scattering Experiments

The main detector to be used for this project

Incident light from a laser (2) is scattered by a single particle in a moving air stream (1), with a camera (3) to capture the images formed as a result of the scattering. Gas with aerosol (1) is pumped through the path of the laser and scatters the light onto the camera, resulting in scattering patterns to be classified using ML.

Reference:

1. Hint et al., “An instrument for the simultaneous acquisition of size, shape, and spectral fluorescence data from single aerosol particles”
2. Kage et al., “Classifying atmospheric ice crystals by spatial light scattering”