1 Abstract
We have just commenced a laboratory project, the “Optical Properties of Volcanic Ash”. This project will measure volcanic ash aerosol extinction spectra and the aerosol particle size distribution. These measurements will allow the calculation of the aerosol cross section which is required in the analysis of IR satellite observations of ash clouds. Dry, water ice and sulphuric acid coated ash are to be measured. The temperature range will represent that of the troposphere to the lower stratosphere. To facilitate these measurements the project extends the capability of the Molecular Spectroscopy Facility at the Rutherford Appleton laboratory. The project has been funded by Natural Environment Research Council (NERC), under its Core-Strategic Measurements for Atmospheric Science (COMAS) program. In this poster presentation we describe the current status of the project.

2 Motivation
The project has a number of end aims. One of which is to allow further assessment of the role of volcanic ash in atmospheric chemistry, and radiative transfer. Applications of the measurements:

- For radiative transfer from:
  - Scattering solar radiation.
  - Absorption in the infrared.
- For chemical reactions:
  - Particles become coated in sulphuric acid, after an eruption causing an increase in the surface area and volume of sulphuric acid aerosol in the stratosphere. These act as a surface or volume for chemical reactions, and reservoirs of reactive species through the uptake of trace gases.

Uncertainties in satellite instruments retrieval schemes of aerosol parameters are currently limited by our knowledge of the optical properties of several aerosol types including volcanic ash. Thus high quality reference measurements of the optical properties of volcanic ash aerosols will add value to satellite instruments (for example ATSR2, AATSR, MODIS, MISR, HIRDLS, TOMS).

Volcanic ash clouds are also potentially damaging to aircraft, causing the malfunction of aircraft systems [1]. Volcanic particles in the ash clouds can enter the engines and melt. In the past two decades two commercial passenger aircraft have had all engines fail after flying into an unanticipated volcanic ash cloud. Timely satellite detection of these clouds would help to reduce this hazard.

3 Method
The extinction cross section is related to the optical transmission by:

$$\beta(\lambda) = \frac{T(\lambda)}{\lambda} \cdot \frac{1}{\text{Path length}}$$

Where:
- T Transmission.
- $\beta$ Volume extinction coefficient.
- $\lambda$ Measurement path length.

The volume extinction coefficient is given by:

$$\beta(\lambda) = \int_{V_0}^{V} \sigma_{ext}(r, m, \lambda) n(r) dr$$

Where:
- $\sigma_{ext}$ Extinction coefficient.
- r Particle radius
- m Particle complex refractive index.
- $\lambda$ Wavelength.
- n(r)dr Number of particles between radii r and $r + dr$.

Hence to obtain the extinction coefficient, $\sigma_{ext}$ we require the measurements of the optical transmission, T as well as the particle distribution, n(r).

4 Samples
At present we have one volcanic ash sample, collected from the Aso volcanic eruptions in 1993. This sample has been collected from a "bomb-shelter" where 1 m to 2 m of ash accumulated (see Figure 1). This is thought to be in a "fresh" state because of the environmental protection of the bomb shelter. In addition to the volcanic ash we also hope to characterize Saharan dust samples. Figure 2 summarizes the proposed measurement conditions. Also shown is the current measurement priorities.

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<th>Ash</th>
<th>Saharan dust</th>
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