A Field-deployable Polar Nephelometer

J.E. Barnes

NOAA Earth System Research Laboratory, Mauna Loa Observatory, Hilo, HI 96720; 808-933-6965, E-mail: John.E.Barnes@noaa.gov

An instrument has been developed that addresses the measurement of the aerosol phase function, an important component in understanding radiative transfer in the earth's atmosphere. The aerosol phase function describes the scattering of light from aerosols as function of angle. There is a wide variation in phase functions which reflect aerosol size, shape and composition. The phase functions are fundamental to many satellite and lidar (laser radar) retrievals of aerosols and are often not well known. Calculations of the phase functions, instead of measurements, are often used and a simple change from spherical to non-spherical particles can have large impacts (50-100%) on the results.

An innovative imaging polar nephelometer has been developed at the NOAA/Mauna Loa Observatory. The instrument measures both the aerosol and molecular phase function *in situ* from approximately 5 to 175 degrees with resolution of better than one degree. The angles are all measured simultaneously with integration times of tens of seconds to a few minutes. The measurement of the molecular phase function, which is well known, provides an absolute calibration of the instrument both in total light scattered and in the angular dependence. The current absolute accuracy is a few percent for a one-minute integration. Multiple wavelengths, and both parallel and perpendicular polarizations of the light, can be measured for additional information about the aerosols.

Version 3 of the imaging polar nephelometer (PNeph) has been constructed and is being tested in the laboratory. The 1.5 meter PNeph is shown below. It can be operated horizontally or vertically. The camera and fisheye lens image the laser which enters the sample chamber on the left and exits on the right. One laser (532 nm) is shown and there is room for a second set of laser, optics, and alignment mirrors side-by-side for an additional wavelength or polarization. The same camera/lens pair will image both beams simultaneously and an 808 nm laser is planned. The 808 nm wavelength is readily available and still in the range of the camera sensitivity.

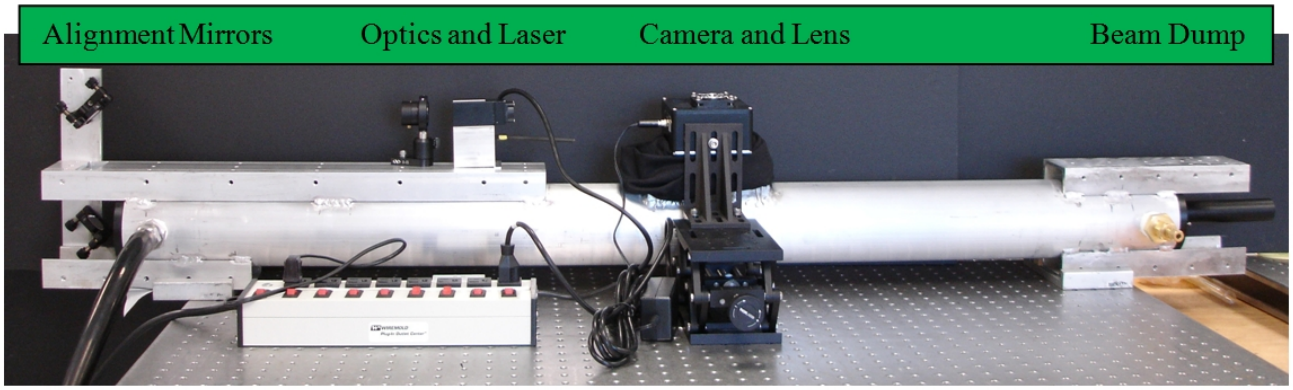

Figure 1. Imaging polar nephelometer in Hilo Laboratory for testing. The camera (center) is using a temporary external mount.