Forward scattering by levitated ice crystals

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Description:

This experimental project is motivated by the need to establish a relationship between the scattering properties of irregular ice particles and their surface morphology. The successful candidate will design and build an optical system for measurements of the forward light scattering on the individual cloud particles suspended in the electrodynamic balance (EDB, see figure 1). With this system, the evolution of two-dimensional forward scattering pattern during the freezing of a suspended water droplet and subsequent evaporation or growth of an ice crystal will be recorded. Providing the simultaneous visual observation of ice crystal we aim at establishing the link between the growth and evaporation conditions of ice crystal, its habit, surface morphology, and light scattering properties. The possible influence of the droplet freezing regime on the shape of the grown ice crystal can be interrogated as well.

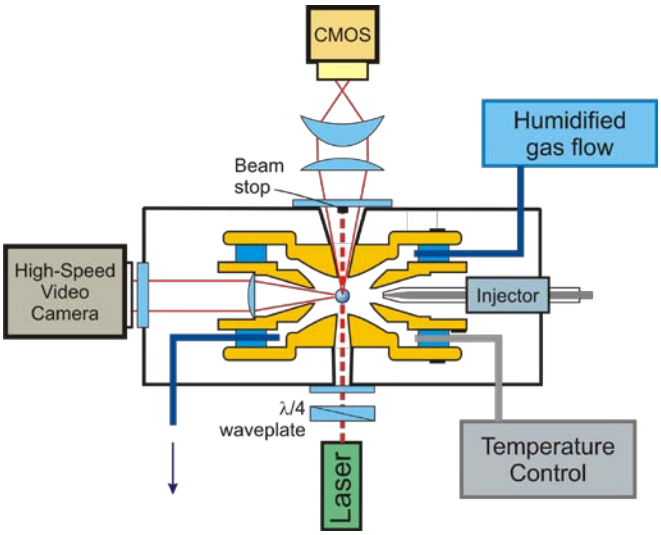

Figure 1. Electrodynamic balance combined with the forward scattering optical system.

The optical system will comprise diode pumped solid state laser (DPSS) emitting linearly polarized beam, beam conditioning optics, broadband illumination source for shadow imaging, high resolution video camera to record the shadow images of levitated particles, forward scattering optical assembly, and high dynamic range CMOS camera for scattered light acquisition. Temperature control of the EDB body will be realized with a cryo-thermostat down to the temperature of -60°C. The EDB main body will be connected to the humidity control system to maintain the relative humidity inside the trap near the water saturation with respect to ice thus controlling ice particle growth or evaporation.

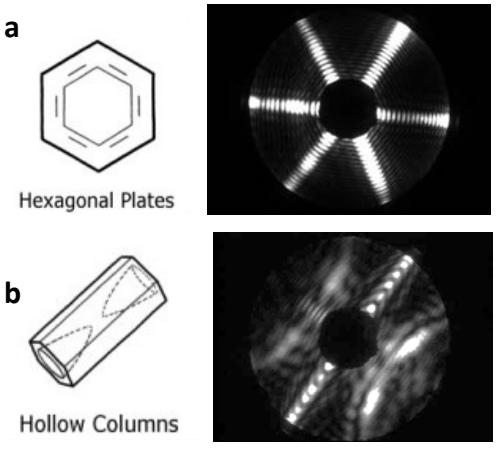

Figure 2. Example of 2D forward scattering pattern recorded with SID3: a) Hexagonal plate; b) Hollow column. *Images courtesy of M. Schnaiter, IMK-AAF*

The recorded 2D scattering patterns (see examples in Figure 2) will be analyzed for the features characteristic for different crystal habits (plates, columns, dendrites) and different surface morphology (smooth or rough).

Experience in practical optical design, knowledge of LabView programming language, and general interest in atmospheric optics applications are beneficial.