Characterization of optically-trapped submicron aerosol particles by ultraviolet broadband light scattering

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The shape, size and refractive index are key properties governing the interaction of aerosol particles with light (Ghan *et al*, 2007). Single particle studies are important for the understanding of how the shape, size and refractive index of aerosol particles are altered by atmospheric processes, such as evaporation, hygroscopic growth and aging. Broadband light scattering experiments (BLS) of single particles are useful to study such processes in the laboratory because they simultaneously measure the particle size and the wavelength-dependent refractive index (Jones *et al*, 2013). Nevertheless, to date, refractive index data from BLS measurements have been restricted to the visible spectral range. Furthermore, despite the relevance of submicron particles in atmospheric processes (Pruppacher *et al*, 1997), particles smaller than 940 nm in radius have never been characterized with BLS (Jones *et al*, 2015).

In this presentation, we report the combination of a new BLS experiment with either a quadruple Bessel beam optical trap (QBB) or a counter-propagating optical tweezers (CPT) to study single submicron particles isolated in air. The QBB trap and CPT both allow stable trapping of single submicron aerosol particles with a very tight spatial confinement (better than 100 nm) (David *et al*, 2015). Our new BLS setup provides data in the UV and visible spectral ranges (320 - 700 nm). The inclusion of the UV spectral range is crucial for the sizing of submicron particles and allows for the retrieval of refractive indices in a range where such data are rare but urgently needed. Particles as small as 300 nm can be characterizes with this UV BLS setup. The factors that determine the absolute uncertainties of the retrieved particle size and refractive index will be addressed in the presentation. Finally, the presentation will highlight the broad applicability of the UV BLS experiment through four examples: 1) the sizing of calibrated submicron polystyrene latex sphere (PSL), 2) the evaporation of binary glycerol water droplets, 3) the hydration/dehydration cycling of aqueous potassium carbonate droplets, and 4) photochemical reactions of oleic acid droplets (David *et al*, 2016).

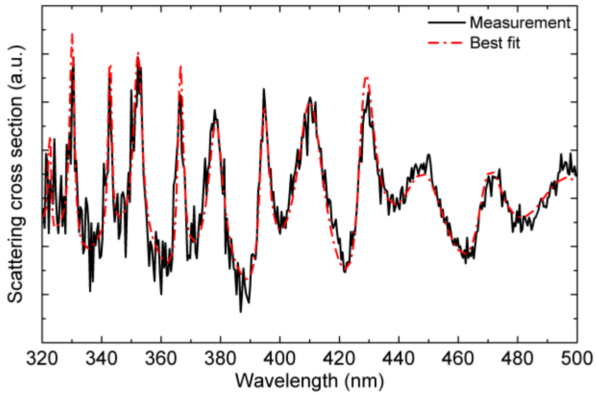

Figure 1. The best fit using Mie calculations providing size and wavelength dependent refractive index for NIST calibrated PSL beads of R = 509.5±7.5 nm radius.

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