Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19924

Quantification of light absorption by trapped aerosol particles with spatial modulation spectroscopy

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Absorption of light by aerosol particles is of key importance in photochemical processes and for the assessment of their direct effect on radiative forcing, which remains very uncertain. However, it is intrinsically difficult to measure light absorption by aerosol particles as distinct from their light scattering, the other contribution to light extinction. This is the reason why quantitative absorption measurements on single aerosol particles are still missing. Here we are developping spatial modulation spectroscopy (SMS) further into a new spectroscopic tool for the precise quantitative determination of the light absorption by single optically-trapped aerosol particles as distinct from light scattering. Conventional SMS is a state-of-the-art technique for measuring the extinction of single particles supported by a substrate[1]. The proposed technical developments extend SMS to aerosol particles isolated in air and to absorption measurements. This new experiment enables fast measurements in the UV or visible spectral range with the capability to retrieve quantitative data on the light absorption, scattering and extinction by trapped aerosol particles. The study of trapped aerosol particles allows to study aerosol processes such as their photochemistry over extended periods of time (several days if necessary) with a time resolution of a few seconds in a well controlled environment (gas composition, relative humidity, temperature). Such time resolved measurements of particle absorption will help improve our understanding of the photochemistry of aerosol particles.

(1) Billaud, P.; Marhaba, S.; Grillet, N.; Cottancin, E.; Bonnet, C.; Lermé, J.; Vialle, J.-L.; Broyer, M.; Pellarin, M. Absolute optical extinction measurements of single nano-objects by spatial modulation spectroscopy using a white lamp. *Rev. Sci. Instrum.* **2010**, *81* (4), 043101. DOI: 10.1063/1.3340875.