(8-220412-A) **A Dual-wavelength Photo-thermal Aerosol Absorption Monitor: Design, Calibration and Performance**

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The direct measurement of aerosol light absorption coefficient is preferrable over indirect methods. Using filter photometers is challenging due to systematic artifacts (Weingartner et al., 2003) and the lack of standardized calibration procedures. A photothermal interferometer probes the change of the refractive index caused by light absorption in (and the subsequent heating of) the sample – the detection is linear and can be traced to first principles. Measurement at two wavelengths determines the absorption wavelength dependence and the Ångström exponent (AAE).

The photothermal aerosol absorption monitor (PTAAM) uses a folded Mach-Zender interferometer (similar to Moosmüller, 1996; Sedlacek, 2006). Pump lasers at 532 and 1064 nm are modulated at different frequencies and focused in the sample using an axicon for simultaneous measurement. The signal is detected by two photodiodes and resolved by dual-channel lock-in amplifiers measuring at the two frequencies. The green channel is calibrated traceably to primary standards using ~1 µmol/mol NO_2 and calibration is transferred to the IR using aerosolized nigrosin (Drinovec et al., 2022).

PTAAM was characterized and its uncertainties quantified (Table 1). We calibrated filter photometers (CLAP, AE33) in green and near IR with soot, and determined their cross-sensitivity to scattering for ammonium sulfate particles, resulting in wavelength and size dependent calibration parameters.

Table 1. Uncertainties of the measured parameters.

$b_{abs,523nm}$	4%
$b_{abs,1064nm}$	6%
AAE	9%

Similar multiple scattering parameter values were found for ambient aerosols and laboratory experiments. We determined the absorption enhancement using laboratory measurements with uncoated and soot and soot coated with secondary organic matter - Fig. 1 (Kalbermatter et al., 2022).

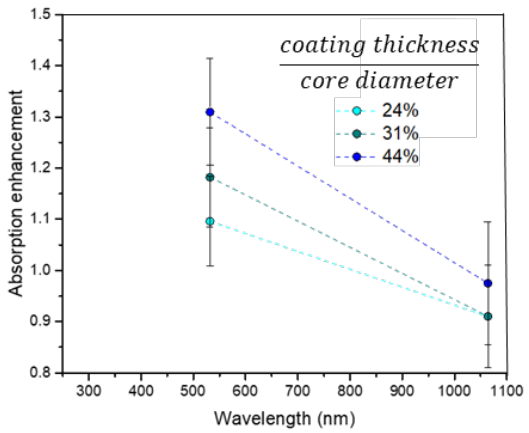

Figure 1. Absorption enhancement due to coating of BC cores with secondary organic matter as a function of the wavelength.