Multi-wavelength Photoacoustic Absorption Spectrometer (MuWaPAS) developed for EUROCHAMP

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At the University of Szeged, Department of Optics and Quantum Electronics a novel multi-wavelength photoacoustic system was developed for measuring the wavelength dependent optical absorption coefficient of either artificially generated or atmospheric aerosols in a wide wavelength range spanning from the UV to the NIR. The instrument is based on the integration of a disc-type Nd:YAG laser and its frequency converted higher harmonics, operating at four different wavelength simultaneously (266nm, 355nm, 532nm, 1064nm), with photoacoustic detection scheme. The wavelength coverage of the system exceeds those of other commercially available optical detection based aerosol monitoring instruments and therefore it has good potential for source apportionment applications too. The photoacoustic detection scheme makes it possible to determine the optical absorption coefficient of aerosols directly, in-situ, with high sensitivity and short response time and by avoiding filter based sampling. Insensitivity to light scattering was demonstrated. Further advantage of the system is that the detection cells are calibrated against optical absorption by using NO_2 as a calibration gas. The system has a rigid mechanical construction and excellent long term stability and it is relatively easy to operate. The minimum optical absorption coefficients detectable by the system are 0.9 Mm^{-1} (@1064 nm), 3 Mm^{-1} (@532 nm), 20 Mm^{-1} (@355 nm) and 50 Mm^{-1} (@266 nm).

The advantages of the system described above were demonstrated by measuring the optical absorption spectra of artificially generated aerosols under laboratory conditions in several measurement campaigns. The optical absorption coefficients determined by the system for soot particles agreed well with those values determined indirectly by using the combination of an extinction spectrometer and a nephelometer.