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# 1 Broadband Cavity Enhanced Absorption Methods – an Overview

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In broadband cavity enhanced absorption (BBCEA) techniques light from a spectrally broad source is transmitted by an optically stable cavity formed by two highly reflecting dielectric mirrors [1]. The light transmitted by the cavity is dispersed by a spectrograph and detected by a multiplex device $e.g.$ a CCD camera. Since the optical absorption pathlengths can be dramatically increased in this way, very high detection sensitivities can be achieved for species exhibiting large cross-sections in a specific spectral range. The concentrations of absorbing species inside the cavity are retrieved by fitting the known absorption spectra's differential structure to the measured spectra, which makes this approach particularly suited to the analysis of mixtures. The achievable detection limits for atmospherically relevant species are comparable to that reached with long-path differential optical absorption spectroscopy (DOAS) setups, however, with much higher spatial resolution.

We demonstrated that broadband cavity enhanced absorption spectroscopy is possible with incoherent white light sources [2]. This approach is experimentally straightforward to implement, the setup is compact and robust and therefore significantly more appropriate for applications in field experiments than corresponding laser-based methodologies.

In this presentation different experimental approaches to broadband cavity enhanced absorption spectroscopy will be briefly reviewed. The measurement principal of our own development using an incoherent light source will be outlined in detail and results of *in situ* measurements of $NO_3$ concentrations in a $4m^3$ simulation chamber will be presented. Since many of the atmospheric gases routinely targeted by DOAS can also be measured by our broadband technique, advantages and drawbacks and the general significance of this method for atmospheric trace gas detection will be discussed.


[1] S.M. Ball and R.L. Jones, "Broadband cavity ringdown spectroscopy", Chem. Rev. **103** (2003) 5239.

[2] S.E. Fiedler, A. Hese and A.A. Ruth, "Incoherent broad-band cavity-enhanced absorption spectroscopy", Chem. Phys. Lett., **371** (2003) 284.