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www.atmos-chem-phys-discuss.net/8/S3736/2008/


Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Using a high finesse optical resonator to provide a long light path for differential optical absorption spectroscopy: CE-DOAS" *by* J. Meinen et al.

**Anonymous Referee #1**

Received and published: 16 June 2008

This paper describes the construction and testing of a cavity-enhanced differential optical absorption spectrometer (CE-DOAS). The instrument uses light-emitting diodes (LEDs) with high surface luminosity, and a simple optical arrangement to couple light efficiently into the optical cavity. The output from the cavity is then directed into a spectrometer/CCD for dispersion and detection. The optical path in the cavity is determined by switching the output to a photomultiplier, modulating the diode and measuring the ringdown time of the cavity. This dual mode of operation seems to work very well. One significant theoretical advance is a formalism for deriving the molecular column density from the optical density for the case of a broadband light source. The authors show that the resulting correction to the column density, which previous workers in this field



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have neglected, can be significant (e.g. 15%).

My overall impression is that this is a very nice piece of work, and offers an important step forward in the field of in situ measurements by optical absorption spectroscopy. That said, the paper requires some revision:

1. The paper contains quite a lot of repetition and could be better organised and much shorter. At the same time, there are important omissions which would place the paper better in context for an atmospheric readership. For example, why was NO3 the target molecule? Is there something about its atmospheric chemistry that is still worth investigating, given the 30-year history of long-path DOAS and more recently cavity ringdown measurements? Can this technique be used for other species of atmospheric interest, and what are the expected detection limits? Does this depend on the availability of suitable LEDs?

2. On page 11, the important formalism (see above) on which the broadband CE-DOAS technique depends is simply quoted as equation (11). Its derivation is apparently going to appear in a future publication. More details should be certainly provided here.

3. In several places thoughout the paper (e.g. page 4, 2nd para) reference is made to a forthcoming book on DOAS. Why do this when several recent book chapters and reviews have been published? I think the latest is J.M.C. Plane and A. Saiz-Lopez, UV-Visible differential optical absorption spectroscopy (DOAS), in Analytical techniques for atmospheric measurement, ed. D. E. Heard, Blackwell (Oxford) 2006, but there are also several earlier reviews from the Heidelberg group.

Minor points

page 2, line 6: through

page 3, 3rd para, 4th line: Herriot

page 3, 4th para, 1st line: through



ACPD

8, S3736–S3738, 2008

page 3, 4th para, 5th line: its

page 6, line 2: ... between two lens optics

page 13, 3rd para, 5th line: smoothed

page 13, 3rd para, 7th line: concentrations ... spectrum were ...;

page 16, 3rd para, 10th line: with a 660 nm SLD

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Interactive comment on Atmos. Chem. Phys. Discuss., 8, 10665, 2008.



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8, S3736–S3738, 2008

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