

Interactive comment on “A broadband optical cavity spectrometer for measuring weak near-ultraviolet absorption spectra of gases” by J. Chen and D. S. Venables

Anonymous Referee #1

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The paper presents a new experimental set-up based on cavity-enhanced absorption spectroscopy to monitor weak absorptions in the near-ultraviolet range. They illustrate the novelty of the set-up with measurements of absorption cross-sections of SO₂, O₃ and ketones, and show how this technique can be used to derive the concentrations of several constituents present in one single sample.

The paper could be published after some minor corrections.

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General comments and remarks 1/ There is no in depth discussion of the error budget. As this paper tries to promote the use of a new method, it should include a detailed discussion on errors. Some issues to discuss here : effects of the determination of R, effect of the lamp drift and fluctuations, effect of photodissociation, adsorption on the walls and on the mirrors, ... The only discussion is p 4586, L 15, but does not go deep enough. L17 : ‘typically around 10% to 15%, acceptable for many application’: a complete analysis of the error budget would give more precise numbers. Is it true that 10 to 15 % of inaccuracy on cross section is acceptable ?

2/ Different wavelengths are indicated throughout the paper which leads to a certain confusion. For example : in the description of the set-up (p 4576, L1) ; 335-375 nm For SO₂: 345-420 nm For O₃: not said but from the plot : 350-376 nm For Ketones: 335-355 nm The make the reading particularly difficult. Moreover if the instrument is sensitive in a certain spectral range, say 335-375 nm, why not give the measurements for all species on this entire interval, even if the cross section falls to 0.0. This would be a good way to test the sensitivity of the instrument towards lamp drift, for example. Then there is the 320 nm used for calibration, and is not in the domain. It would be interesting to have the plots showing this wavelength in each case. If you are using this wavelength for calibration, I assume you know the R value at that wavelength ?

3/ Resolution of the instrument: p 4575, L18 ‘approximately’ is not enough for such observations. Resolution is one of the critical parameters for cross sections. True values, deduced from measurements of the ILS should be given. Is this resolution constant on the whole spectral interval ?

4/ Discussion on the mirror calibration (P 4578, L 11) a/ I am confused again by the use of the different wavelengths : 320 nm to scale the cross section, 353 nm to determine the R(@353nm) ? Again what about R(@320 nm) b/ ‘the cross section used was the average of four literature values. . . ’ : what was the standard deviation ? Would be interesting to have this value on plot 5, from which it is not clear if the value @ 353 nm is given. If it is the utmost point at the left, then the values from the literature are

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not identical (considering the logarithmic scale of the plot) What is the impact of this average value on the precision of the measurement.

5/ It would help the reading if there was a table (or several tables, one for each species) summarizing some instrumental parameters (range, resolution, temperature, ...) for the literature data

6/ p 4582, L 17: ' (Fig 7) exhibits lower noise over this region' : I do not see a lot of noise on the data from the literature. In Fig 7, several data sets of the literature are plotted, but no reference to their experimental parameters (see rmq 5) or discussions are given in the text.

7/ No quantitative analysis of the comparisons is presented. The authors speak of good or less good agreement, but do not provide % difference or absolute differences

8/ Comments on the Plots They should all cover the entire sensitive spectral interval of the instrument, including the 320 nm used for calibration Fig 4: it is not enough to plot the maxima of the convoluted spectra, the values in the holes will be also modified by the convolution Fig 6: last sentence of the caption is not clear

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