https://doi.org/10.5194/amt-2021-245

A simulation chamber for absorption spectroscopy in planetary atmospheres by Marcel Snels, Stefania Stefani, Angelo Boccaccini, David Biondi, and Giuseppe Piccioni submitted to AMT.

Summary

This paper report the design and test of a simulation chamber including a White cell (and in the future a high finesse cell for CRDS measurements) allowing recording transmission spectra of different gas mixtures of atmospheric interest over large temperature (from 100 K to 550 K) and pressure (up to 60 bar) ranges.

General comments

This paper is well-written and the design of the simulation chamber is well-explained and described. Performances in terms of temperature stability and homogeneity are particularly good over the whole temperature range and sufficient for most of the applications dedicated to the planetary atmospheres if we except the Earth's atmosphere where, for example, green house gases monitoring requires a very accurate knowledge of the temperature dependence of the spectroscopic parameters and thus a better temperature homogeneity. My fist remark concerns the discussion about the recorded spectra which needs to be fleshed out: nothing is said about the noise level and the base line stability of the spectra while these aspects are essential to obtain accurate spectroscopic parameters and cross-sections for the continua. The large volume of the cell could also be a problem when using expansive isotopically-enriched species or hazardous gases. This has to be mentioned. A table summarizing the gas temperature homogeneity and stability at the different achievable temperatures has to be included in the paper.

This paper deserves to be published in AMT with minor modifications.

Minor remarks/comments

L27: …FTS mea**s**urements.

L67-71: The following reference should be cited: Guinet, M., et al. *Performance of a 12.49 Meter Folded Path Copper Herriott Cell Designed for Temperatures Between 296 and 20 K*, Applied Physics B 100 (2010): 279–282.

L97: *double wall stainless steel tubing*: this is not clear to me what it exactly means. Could the authors reformulate this sentence?

Fig. 2: Indicate in the caption what TC, PSV, LN2, GN2 mean. It will be more comfortable for the reader.

L171: Please give information about the detector and its electronics (type of the detector, detectivity, bandwidth…).

L181: *The base length of the White cell optics will vary less than +/- 1 mm…* How this value is determined? Measured of calculated from the thermal expansion coefficient?

Fig. 5: In the caption please recall the total length of the sample cell and of the White cell.

Fig. 6: The legend on the figure doesn't correspond to what is written in the caption.

L207: *calculated temperature*: how is this temperature calculated?

Fig. 7: Why not making the comparison by doing temperature steps and waiting for temperature to stabilize? What are the temperatures measured by the other thermocouples? The accuracy of the TC has to be given.

In the caption of this figure: *The red curve corresponds with the calculated gas temperature* has to be replaced by: *The red curve corresponds **to** the calculated gas temperature.*

Fig. 8: The area zoomed on the lower panel has to be indicated (by a rectangle for example) on the upper panel.

In the caption: *stabliaztion -> stabilization*.

L230: *stabile -> stable*

L230-235: The authors have to clearly distinguish between the gas temperature stability with time and the gas temperature homogeneity (in space). Both values have to be given in a table for different temperatures over the entire temperature range (see my general comment).

L237: Please indicate the reference of the commercial White cell.

L239: *corresponding with -> corresponding **to***

L244-245: *carbondioxide -> carbon dioxide*

L243-249: It is important to recall here that the n-1 path length is 2.4 m and the n+1 path length is 4 m so that there is no doubt about the determined path length even if there are some uncertainties on the intensities of the CO_2 transitions.

Fig. 10: Add also a fit of the spectra and show the fit residuals on a distinct panel. This will allow discussing the noise level of the spectra.

In the caption: *carbondioxide -> carbon dioxide*