

Review of Habilitation Thesis

Author/Applicant: Mgr. Peter Čermák, PhD.

Title: Molecular Spectroscopy in the 2.3 μm Atmospheric Water Window

**Institution: Faculty of Mathematics, Physics and Informatics,
Comenius University in Bratislava**

The submitted habilitation thesis was evaluated based on the following criteria.

Author's Introduction

Dr. Čermák is an author and co-author of 29 publications with over 160 citations; he presented several conference talks and has active cooperation with PhLAM Lille and LiPhy Grenoble, where he graduated from. He participated on several projects and was PI of VEGA and SK-FR-APVV grants. As a university research assistant, he has been teaching several courses since 2012 and he supervised one MS and one BS theses. All these achievements are not only impressive, but also I assume that they fulfil requirements to award him with the habilitation at the FMPHI faculty.

Habilitation Content

The text of habilitation thesis has approximately 30 pages and is supported with 11 publications, what both are sufficient. The text is written in English, as distilled from the publications, what can be appreciated, however a compact story in Slovak could have been even nicer. The work contains all aspects, interesting spectroscopy CRDS - cavity ring down spectroscopy, equipment developing as VECSEL - vertical external cavity surface emitting laser, and prospective applications of atmospheric gases with high resolution and sensitivity.

Questions and Comments:

1. I have a naive question, whether the CDRS/VECSEL set-up is also available in Bratislava, or there is only cooperation access in France. Could you comment on a budget of such a set-up?

Results and Significance

Among of the 11 supporting publications I focused on 3 where Dr. Čermák is also the first author on two of them. The first one is from Review of Scientific Instruments, where the mentioned new technique was described. The second one is a manuscript where this spectroscopy is nicely combined with thermodynamics. The third one is from Chemical Physics Letters, as was also selected as "Editor's Choice". This contribution provides first determination of the first overtone electric quadrupolar band.

Questions and Comments:

2. Could you comment on parameters like Line Strength and Line Intensity, their dependence and what is then estimated sensitivity of the CDRS/VECSEL technique?
3. The CO₂ concentration is atmosphere on the level of 100s ppm, though the experiments are performed at pressure of 100s Torr, what is the correlation?
4. The thermodynamic study provides solid-gas equilibrium of methane, is there any relevance of the experiment with these states of phase in real atmosphere?
5. In the spectra of N₂, the presence of NH₃ and H₂O is also observed, although the pressure of N₂ is on the level of 100s Torr, the estimated concentration of NH₃ 100s ppt, and the estimated concentration of H₂O 100s ppm? What is the origin of such a huge range, assuming very different Absorption Coefficients?
6. Observing N₂ on the level of 100s Torr together with NH₃ with the concentration of 100s ppt, how one can exclude the presence of NO_x species, for example? Could you comment on selectivity of the technique and relevant spectral resolution?
7. Just a note for Figure 1.1 of the thesis, the mentioned "trace elements" are trace molecules.

Conclusion

Dr. Čermák performed very difficult experiments, participated on the equipment development, published 29 papers with 160 citations, presented conference talks, he was PI of projects and has been teaching and supervising since 2012. Assuming that Dr. Čermák fulfils all official requirements, I do explicitly support and recommend to award him with the habilitation and the title "docent".