EGU21-16428
https://doi.org/10.5194/egusphere-egu21-16428
EGU General Assembly 2021


# A portable dual-channel laser heterodyne radiometer for simultaneous remote measurements of CH4 and CO2 in the atmospheric column

**Jingjing Wang**[2], Tu Tan[2], Zhengyue Xue[2], Xiaoming Gao[2], and Weidong Chen[1]
[1]Laboratoire de Physicochimie de l'Atmosphère, Université du Littoral Côte d'Opale, 59140 Dunkerque, France
[2]Anhui Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, 230031 Hefei, China

Laser heterodyne spectroscopic measurement technique[1] has been proved to be a powerful and effective remote sensing tool for measurements of greenhouse gases in the atmospheric column[2-6]. In the present work, we report the development of a portable all-fiber coupled dual-channel laser heterodyne radiometer (LHR) and its field deployment. Two DFB lasers operating at 1650.9 nm and 1603.6 nm are used for the remote measurements of column $CH_4$ and $CO_2$, respectively. A fiber optic switch is used to modulate and split the collected sunlight into two channels for simultaneous measurements of both target greenhouse gases. Custom-made preamplifiers combined with digital lock-in amplifiers are used to extract the laser heterodyne signals. The spectral resolution of the instrument is about 0.00442 $cm^{-1}$, and the signal-to-noise ratio of the measured spectrum of about 250 is achieved with 0.8 s average time per sampling datum. The developed LHR instrument was successfully deployed to a field atmospheric observation experiment (in Dachaidan district, Qinghai province, China).

The experimental detail including the LHR instrument integration, dual-channel measurement results of column $CH_4$ and $CO_2$ and preliminary data inversion results will be presented and discussed.

**Acknowledgments.** The project was supported by the national key R&D program of China (2017YFC0209705). The authors thank the financial supports from the CPER CLIMIBIO program, the Labex CaPPA project (ANR-10-LABX005).

## References

[1] D. Weidmann, T. Tsai, N. A. Macleod, G. Wysocki, Opt. Lett. **36** (2011) 1951-1953.

[2] E. L. Wilson, A. J. DiGregorio, G. Villanueva, C. E. Grunberg, et al., Appl. Phys. B **125** (2019) 211-219.

[3] D. S. Bomse, J. E. Tso, M. M. Flors, J. H. Miller, Appl. Opt. **59** (2020) B10-B17.

[4] J. Wang, G. Wang, T. Tan, G. Zhu, C. Sun, Z. Cao, W. Chen, X. Gao, Opt. Express **27** (2019) 9610-9619

[5] A. Rodin, A. Klimchuk, A. Nadezhdinskiy, D. Churbanov, et al., Opt. Express **22** (2014) 13825-13834.

[6] E. L. Wilson, M. L. McLinden, J. H. Miller, H. R. Melroy, et al., Appl. Phys. B **114** (2014) 385-393.