Université de Lille

FACULTÉ DES SCIENCES ET TECHNOLOGIES

Master Physique
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International Master 2 Atmospheric Environment: Research Training 2020-2021

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CaPPA Work Package: WP-1 From gas phase to aerosols

Ground-based measurements and analysis of greenhouse gases in the atmospheric column using Laser heterodyne radiometer (LHR)

Measurement of vertical concentration profiles of key atmospheric trace gases (such as CH_4, N_2O, CO_2, H_2O vapour) is extremely important for our understanding of atmospheric chemistry, regional air quality and global climate change trends. In this context, laser heterodyne radiometer (LHR) has been developed [1-4] which performs ground-based remote measurements of absorption spectrum of the Sun light by molecular trace gases in the atmospheric column. Solar radiation undergoing absorption by the atmospheric gases is collected and coupled into a LHR where the sunlight is mixed with a laser source tunable in frequency (called local oscillator, LO) in a fast photodetector. Beating note at radio frequency (RF) resulted from this photomixing contains absorption information of the LO-targeted molecular gases. Scanning the LO frequency across the target molecular absorption lines allows one to extract the corresponding absorption features from the total absorption of the solar radiation by all molecules in the atmospheric column.

Near-IR (~1.5 µm) and mid-IR (~8 µm) [5] LHRs have been recently developed in the LPCA and deployed to field measurements of CH_4, N_2O, CO_2 (including $^{13}CO_2/^{12}CO_2$), H_2O and HDO vapour in the atmospheric column. According to the interest and the capacity of the candidate, the training topic may be the development of a new advanced LHR or an algorithm for retrieving vertical profile of trace gas concentration based on its measured LHR spectrum.

References

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