MULTICHARME : A NEW CHERNIN TYPE MULTIPASS CELL FOR LONG PATHLENGTH TERAHERTZ SPECTROSCOPY EXPERIMENTS IN AN ATMOSPHERIC SIMULATION CHAMBER.

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For the first time, THz spectroscopy was used for a direct monitoring of molecular species in the Dunkirk atmospheric simulation chamber called CHARME for Chamber for the Atmospheric Reactivity and the Metrology of the Environment[a]. Within this chamber, we have developed a specially designed Chernin multi-pass cell "MULTICHARME" allowing to adjust a pathlength from 120 m. (24 paths) to 280 m. (56 paths) coupled to a submillimeter wavelength radiation. We demonstrate the capability to detect and quantify greenhouse gases at trace levels by probing their rotational transitions close to the Doppler broadening limit. Significant absorbances of 400 ppm residual N_2O traces at 577.58 GHz and 200 ppm O_3 traces have been measured with a path-length adjusted to 200 meters.[b] Right now, the accessible detection levels for both compounds are limited to tens of ppm. We are presently developing a model of the baseline in order to correct the strong variations caused by multiple interfering stationary waves in the Chernin cell. The first results obtained in CHARME coupling a THz source to the MultiCHARME Chernin cell opens new possibilities especially for the monitoring of stratospheric reaction processes at low-pressure. In particular, the versatility of the submillimeter electronic sources will allow to perform time-resolved quantitative spectroscopies of reactants, oxidants and products involved in targeted reactions occurring in the high altitude atmospheric layers.

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[a]Meng, L.; Coeur, C.; Fayad, L.; Houzel, N.; Genevray, P.; Bouzidi, H.; Tomas, A.; Chen, W., *J. Atmos. Environ.,* **240, 1117740, 2020.**

[b]Cuisset, A.; Hindle, F.; Mouret, G.; Bocquet, R.; Bruckhuisen, J.; Decker, J.; Pienkina, A.; Bray, C.; Fertein, É.; Boudon, V., *Appl. Sci.,* **11, 1229, 2021.**