PhD student position in experimental ultra-high precision molecular spectroscopy

Laboratory : Laboratoire d'Etudes du Rayonnement et de la Matière en Astrophysique et Atmosphères (LERMA), CNRS - Observatoire de Paris - Sorbonne Université, Paris

Team : Spectroscopie Moléculaire et Instrumentation Laser pour l'Environnement (SMILE, LERMA)

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High-Precision laser spectroscopy of ozone in the UV for atmospheric applications

Ozone is a key molecule for atmospheric composition and climate change and its accurate and traceable measurement in the frame of international networks, measurement platforms and space missions for Earth and climate observation is crucial. In-situ and remote sensing techniques rely on absorption data that suffer from uncertainties and biases in the several %-range. An improvement in atmospheric measurements is required for evaluating the recovery of the ozone layer and for studying the impact of atmospheric ozone on climate change.

This thesis aims at improving spectroscopic data for remote sensing of ozone in the 306-320 nm range which is particularly important for remote sensing in the upper troposphere-lower stratosphere (UTLS) region, where the impact of ozone on climate is largest and where ozone trends are yet most uncertain and critical. Using newly available laser technology based on sum frequency generation from high-power tunable IR lasers with subsequent frequency doubling (SHG), the candidate sets up a new experiment for temperature-dependent precision photometric absorption cross section measurements of ozone. In a group which is internationally renowned for its work on ozone, a unique setup for absolute ozone absorption measurements linked to new international ozone standards [1] will be realized that target a sub-percent accuracy of ozone cross sections [2]. The new data generated within this thesis work will represent a major contribution to the currently ongoing international effort at revising spectroscopic data that limit the measurement of atmospheric ozone and the observation of its trends for integrated Earth and climate observations.

This thesis will be funded by the French national research agency (ANR) within the ALPHA-O3 project and realized in close collaboration with partners from LP2N (Bordeaux) who are responsible for the development of the laser system and from LATMOS (Paris) and GSMA (Reims) who are performing ground based remote sensing measurements at the atmospheric observatory in Provence, France. The position is open starting from September 1, 2023.

[1] Hodges, Viallon, Brewer, Drouin, Gorshelev, Janssen, Lee, Possolo, Smith, Walden, and Wielgosz. Recommendation of a consensus value of the ozone absorption cross-section at 253.65nm based on a literature review. Metrologia, 56(3):034001, 2019. doi: 10.1088/1681-7575/ab0bdd.

[2] Janssen, Elandaloussi, and Gröbner. A new photometric ozone reference in the Huggins bands: the absolute ozone absorption cross section at the 325 nm HeCd laser wavelength. Atmos. Meas. Tech., 11(3):1707–1723, 2018. doi: 10.5194/amt-11- 1707-2018.

Requirements:

The applicant should possess good basic knowledge in physics and optics, show motivation, be an interactive team player, have good communication skills both orally and in writing, and have experience in scientific programming (Labview, python, C#, …). Interest in atmospheric sciences is a plus.

Interested candidates should send their motivation letter and an exhaustive CV along with the addresses of persons who are willing to send recommendation letters to Christof Janssen.