Master 2 "Systèmes Complexes, Optique, Lasers (SCOL)": Research Training 2022-2023
Master 2 "Matter Molecules and their Environment(MME)": Research Training 2022-2023

Appel à sujet de stage recherche / Call for research training subject

Laboratory: PhLAM UMR CNRS 8523

Supervisor: MARGULES Laurent

Tél : 03.20.43.48.08, E-mail : laurent.margules@univ-lille.fr

Collaborator(s): MOTIYENKO Roman

Topic: Spectroscopy

Master 2: select the master and the most appropriate option

□ Master 2 SCOL	x Master 2 MME (GP-SCP)
□ Option Complex Systems (GP-IKS)	□ Option Condensed Matter
	□ Option Condensed Matter/Pharma
	X Option Dilute Matter and Spectroscopy
	□ Option Atmospheric Sciences
	□ Option Modeling at the molecular & atomic scales

Studies of radicals of astrophysics interest

Recently the need for improving the astrochemistry models have been further exacerbated by the detection of various molecules in dark, cold clouds for which standard gas phase chemistry and grain surface chemistry do not explain the observed abundances. In particular, some key radicals, such as methoxy (CH_3O), and COMs such as CH_3OCH_3, CH_3OCHO, $HOCH_2CH_2OH$ (among others) have been found in very cold regions. How secondary photons or other energetic processes can lead to the production of these organic radicals and organic molecules in dark, cold clouds is not clear. Moreover, if these radicals can also be produced in hot molecular clouds, COM chemistry should. For this reason, radicals will be the main targets of the present project. It should also be stressed that only a few radicals have been detected so far in the interstellar medium (ISM) because laboratory data for these species are still scarce.

The laboratory spectroscopy of radical species is difficult. These compounds need to be created in situ as they are not kinetically stable. Their spectroscopy requires rapid spectral acquisition because of their high instability. The spectroscopic group of the PhLAM laboratory in Lille has developed a state-of-the-art absorption spectrometer offering both high precision with frequency measurements and fast scanning spectral acquisition.

We are developing a new cell with a jet expansion and a discharge applied to the nozzle. To our knowledge only one such setup combining a multipass approach and a jet is running in the submillimeterwave range. Our first tests with the new "discharge" cell are promising, the system is functional. During this project we would like to improve the sensitivity of our set-up by increasing the number of jets from one to three and also adding a multipass system in the actual cell.

Key words: spectroscopy, astrochemistry, millimeterwave, radicals