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

Supervisor: Elias Neeman

Tél : 03.20.43.49.05, E-mail : elias.neeman@univ-lille.fr

Collaborator(s): Manuel Goubet (manuel.goubet@univ-lille.fr)

Topic: Gas-Phase Molecular Physics

Master 2: select the master and the most appropriate option

□ Master 2 SCOL	□ 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

Characterization of PAHs and their derivatives by Rotational spectroscopy and quantum chemical calculations.

Polycyclic aromatic hydrocarbons (PAHs) are important molecules in planetology and astrophysics: PAHs and their derivatives (nitrogenous analogues, radicals, ions, ...) are strongly suspected to be at the origin of unidentified signals observed in the interstellar medium. The identification of spectral signals recorded during observational campaigns is based on the precise knowledge of the signature of candidate molecules previously recorded in the laboratory. To date, this method has already allowed the detection of about 250 species in the interstellar medium. The resolution and sensitivity of the radio astronomical observatories have been increasing in recent years, thanks to instrumental developments in astrophysics. The extremely high number of unassigned transitions in high quality and high-resolution data reveals more than ever the lack of laboratory studies for many candidate molecules for detection and mainly PAHs. Recently, some PAHs derivatives (indene, 1- and 2-cyanonaphthalene) has been detected in the interstellar medium by radio astronomy based on their data previously obtained in laboratory.
The internship project focuses on the development and use of a device for the production of open shell species such as radicals, dehydrogenated or protonated PAHs. These species will be mainly observed thanks to a pulsed microwave spectrometer (pure rotation spectroscopy) coupled to a pulsed nozzle combining vaporization and high voltage discharge. To our knowledge, only 4 equivalent devices exist to date and none of these teams has focused on PAHs, their derivatives and aggregates. A test phase will first be performed on radicals and ions of carbon chains, some of which have already been studied. Then, the two priority target species will be the protonated and dehydrogenated Naphthalene. Eventually, this device could be used to characterize the reaction and/or aggregation processes of PAH radicals.

Key words: Microwave Spectroscopy, open shell species, PAH, Molecular Physics, Astrophysics.