

**Object: 3 years PhD scholarship in Physical Chemistry applied to astrochemistry in ASTRO team at the PIIM laboratory of the Aix-Marseille University in France**

**Molecular complexity in astrophysical objects**

**Directeur de thèse : Fabrice Duvernay**

**Co-directrice : Nathalie Pietri**

**Summary of thesis project:** We propose to study in the laboratory the evolution and complexification of organic matter in stellar nebulae up to its incorporation into small solar system objects (comets and asteroids). The aim is to understand the origin of the formation of complex nitrogenous molecules (nitriles, amines, amides, cyanopolyynes) in the conditions of the interstellar medium, in small solar system objects (comets and asteroids) and in planetary atmospheres. At very low temperatures (10 K- 100 K), we will deposit primitive molecules (H<sub>2</sub>O, CO<sub>2</sub>, CO, NH<sub>3</sub>, H<sub>2</sub>CO, HCN, etc.) that make up interstellar ices. We will then simulate their evolution by irradiating them with VUV photons (120 nm) and electrons (0.1 – 10 KeV). We have experiments capable of simulating the vacuum (10<sup>-9</sup> mbar) and temperature (10-300 K) conditions of such environments (AHIA, RING, RARICI devices). The evolution of ice composition will be measured by infrared spectrometry, mass spectrometry or low-temperature EPR spectrometry. The latter technique (EPR) - rarely used in astrochemistry - will enable us to characterize the radical species formed during irradiation of the ices, and to study their lifetimes at low temperatures (10-100 K), as well as the formation mechanisms of complex organic nitrogen molecules formed in irradiated primitive ices. These studies are also intended to provide astrophysicists with new compounds potentially detectable in cometary environments or in star-forming regions. The results obtained will therefore be particularly useful in the interpretation of data collected by missions dedicated to the analysis of cometary nuclei and asteroids, or by observation satellites (JWST). These data will also be useful to astrobiologists studying (among other things) the role of interstellar and cometary organic matter in the emergence of life on Earth.

**Administrative information:**

-Application Deadline: Mai 1th, 2024

- The position is for three years doctoral contract (October, 2024 - October, 2027).

-Recruitment is by competitive audition at doctoral college (05/28/2024).

- Applicants must have a Master degree in chemistry by the date of appointment.

- Applicants should submit a cover letter, a CV, a statement (2 pages max) explaining interests and qualifications. Contact: Fabrice Duvernay (fabrice.duvernayniv-amu.fr).