

PhD GRANTS 2024

PhD project title: Characterization of transient species by laboratory spectroscopy for their detection in the interstellar medium.

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PhD project summary (max. 20 lines):

Our understanding of the physico-chemical processes occurring in various objects in the interstellar medium relies mostly on spectroscopic observations. Laboratory spectroscopy carried out at ultra-high spectral resolution allowed the unambiguous detection of more than 250 molecules in the interstellar medium thanks to data recorded in the millimeter and submillimeter wavelength range (50-1000 GHz). Among these species, transient species (radicals, ions, unsaturated carbonaceous molecules) represent more than 65% of the species identified to date, but their high reactivity makes their spectroscopic characterization in the laboratory extremely difficult. The aim of the PhD thesis project is to record and analyze the spectra of large radicals and ionic molecules (containing more than 5 heavy atoms, C, N, O) using recently developed complementary devices at PhLAM. (Lille) and at ISMO (Orsay). The doctoral work could be supplemented by the development of new instrumental tools making it possible to initiate high-resolution spectroscopic studies of protonated molecules: a new source producing the H₃⁺ ion which will serve as a “proton donor” to the chosen precursor species. This approach will allow the selective synthesis of protonated molecules, which are predicted in abundance in astrochemical models.

The proposed subject has a strong coloration of molecular spectroscopy at high spectral resolution in the laboratory and with strong interaction with groups of astrophysicists for detections in the interstellar medium. It can be supplemented by instrumental development work depending on the skills of the PhD student.