Open PHD position in Astrophysics  
(October 2019)

Subject: The nitrogen enigma in pre-stellar cores.  
Supervisors: Prof P. Caselli (MPE, Garching, Germany) and prof F. Dulieu (LERMA, University of Cergy-Pontoise & Paris Observatory, France)

Thesis project
In the star formation cycle, the dark cloud phase precedes the birth of stars. Due to the high density and very low temperature conditions all species should a priori be trapped on the surface of the grains. This is not the case, and in particular the N2 molecule (detected through N2H+) seems to be more resistant to freeze out. Molecules such as CN, CH3CN or HNCO are detected, and NH3 maintains large abundances toward the center of dense cores, in disagreement with chemical models. Similarly, molecules containing an amine group (NH2CHO, NH2OH) are not detected, while their methylated counterparts (CH3CHO, CH3OH) are. The synthesis on dust grains of N-bearing molecules, particularly amines, is poorly understood and so models cannot explain if different N-bearing molecules have different chemical origins.

The purpose of the PhD is to experimentally study the formation of N-molecules on cold surfaces and to model the chemistry of nitrogen in dense cores. The experimental part will be carried out in Neuville under the responsibility of F. Dulieu, while the modelling and comparison with observations will be carried out at the MPI in Garching under the supervision of P. Caselli.

Scientific objectives
The objectives of this project are as follows:
1 - study the formation of ammonia (and other nitrogen-bearing molecules) on cold dust grains, with particular attention to the issue of chemical desorption and deuteration;
2 - revisit nitrogen chemistry in the context of dark molecular clouds taking into account the new measurement of binding energies and new chemical pathway efficiencies measured in the laboratory;
3 - merge the first two points and find out if the problem of anomalous nitrogen depletion and the discrepancy between observed and modeled abundances of N-bearing molecules originate in the gas-grain chemistry, and/or if the cloud dynamical evolution is the real limit of our understanding.

Practical details
The student will be recruited internationally, within the framework of the Paris Seine doctoral school http://www.collegedocitoral.u-cergy.fr/. The student will share his time between the two institutions and will be paid for the first 18 months on the basis of French doctoral contracts, and the last 18 months by the MPI, on the basis of German doctoral contracts. The PhD student will be affiliated to ACO ITN network, and will participate to the training schools.

Application
Applicant must have a master degree in Science, especially in Astrophysics, Physics or Chemistry at the beginning of the contract. An experience (Internship, master diploma...) in radioastronomy or experimental physics would be an effective positive aspect of the application. Applicant must have excellent communication skills in English (oral and written), which will be the working language, although the student will follow French language training (part of Doctoral School educational program), and may learn German, Italian and few others languages with the team crews if motivated.

Applications should be constituted of a detailed CV and a letter of motivation. The candidate should furthermore arrange for a recommendation letter from a professor familiar with the applicant to be sent to Prof. Dulieu. A remote interview will be organized for shortlisted applicants. Applications received before 5th of June 2019 will receive full consideration. The offer will close later, as soon as one eligible and selected candidate accepts the job.

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