OFFRE DE STAGE M1/M2

Master PFIQMC

Physique Fondamentale, Ingénierie Quantique et Matière Condensée
Durée : 6 semaines (M1), 4-5 mois (M2)

Laboratoire d'accueil :	Laboratoire Collisions Agrégats Réactivité
Equipe d'accueil :	Agrégats

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Intitulé du stage :	Collision induced dissociation of complexes molecular systems of astrophysical interest

Cosmic nanograins play key roles in the physical and chemical evolution of the interstellar medium. Indeed, these nanosized catalytic platforms can interact with molecules of the gas phase (e.g. H_2O, CO, etc.), through adsorption and desorption processes, which can result in the production of new species that chemically enrich star and planet forming regions. We are especially interested in carbonaceous nanograins made of polycyclic aromatic hydrocarbon (PAH) molecules and their derivatives [1]. In presence of water and UV photons, PAHs are expected to be oxidized, thus forming alcohol or ketone molecules [2,3] which are of prebiotic interest.

During two previous beamtimes, the first at the SOLEIL synchrotron and the second at the ILM laboratory, we have studied PAH-water cationic complexes with different experimental setups in order to explore their dissociation properties (fragmentation channels, energetics and dynamics). These setups were equipped with an ion trap capable of performing collision induced dissociation (CID) at controlled collision energy that allows to measure the fragmentation channels of a parent species as a function of the internal energy injected into it. In particular, we could study CID of the pyrene-water cationic complex ($[(C_{16}H_{10}):OH_2]^+$) and its dehydrogenated form ($[(C_{16}H_9)OH_2]^+$) and the 1-hydroxypyrene cation ($[C_{16}H_9OH]^+$) and its hydrogenated form ($[HC_{16}H_9OH]^+$). Despite their similar compositions and structures, the raw CID data of these molecular systems are very different and show fragmentation pathways which are specific to each species.

The aim of this internship will be to analyze the CID data obtained during the two beamtimes in order to shed light on the fragmentation pathways of these complex systems and to better interpret the observed differences. Depending on the student involvement and interest, she/he will also participate to threshold CID measurements done with the experimental setup in LCAR and/or he/she will also build a statistical model that will help to extract dissociation energies and rates.

Reference

[1] Pilleri, P. et al. A&A 542, A69 (2012).
[2] Bernstein, M. P. et al. Science 283, 1135-1138 (1999).
[3] Bouwman, J. et al. A&A 511, A33 (2010).