Fritz-Haber-Institut der Max-Planck-Gesellschaft

Physikalische Chemie — Direktor: Prof. Dr. Martin Wolf

MAX-PLANCK-GESELLSCHAFT

Department Seminar:

Monday, February 11, 2019, at **11:00** a.m.;
— all are invited to meet at around 10:40 for a chat and coffee —

Dr. Mathieu Bertin Laboratoire d'Études du Rayonnement et de la Matière en Astrophysique, Faculté des Sciences et Ingénierie, Sorbonne Université & Observatoire de Paris.

Thermal and photon-induced desorption processes from molecular ices relevant to the interstellar medium

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PC Seminar Room G2.06, Building G, Faradayweg 4 J. Stähler

Abstract:

In the colder regions (~ 10 – 100 K) of space, the matter is predominantly molecular, physisorbed at the surface of micrometer-size dust grains. These icy mantles are the main reservoir of molecules: they can act as catalysts for further chemical complexity, and enrich the gas phase by means of desorption processes. The modelling of the astrochemistry in these cold media is a key-step for the interpretation of the observational data obtained by the IR- and radiotelescopes, whose resolving power and sensibility are ever increasing – and ultimately is fundamental for the understanding of star and planet formation. It also requires a fine understanding on a collection of fundamental physical-chemical processes. Among them, the desorption processes present a particular importance in the astrochemical models since they may control dramatically the gas-to-ice abundances ratio, and thus the chemistry. Depending on the temperature of the grains, both thermal and non-thermal desorption processes are at play, and each of these processes needs to be quantified.

I will present experimental approaches that are used to constrain the efficiency of both thermal and photoinduced desorption from model molecular ices. Thermal desorption from cold ice is studied by the TPD method, from which multi-heating rate experiments can provide both adsorption energies and exponential prefactors,[1,2] the latter being usually arbitrary chosen by empiric formula whose validity can be debated for big and tightly bounded molecules. The UV photodesorption is studied using the tunable UV ouput of synchrotron facility at SOLEIL, opening up the possibility to extract both absolute efficiencies in the 7 – 14 eV range, and bringing valuable information on the underlying mechanisms of desorption by the identification of the first absorption steps within the ice.[3] Some perspective of these works will also be given, in particular concerning the role of higher photon energies (soft X-rays) in the photodesorption from molecular ices.[4].

[1] Doronin et al. 2015, J Chem Phys 143, 084703
[2] Bertin et al. 2017, A&A 598, A18
[3] e.g. Bertin et al. 2013 ApJ 779, 120 ; Bertin et al. 2016 ApJ 817, L12 ; Dupuy et al. 2017, A&A 603, A63
[4] Dupuy et al. 2018, Nat. Astron. 2, 796