Photon Stimulated Desorption from interstellar ice analogs: recent results using synchrotron radiation.

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Photon Stimulated Desorption (PSD) processes play a key role in the exchanges between the gas and solid phases of cold regions of the interstellar medium, where a lot of molecules are expected to freeze out on dust grains with the temperature forbidding their thermal escape. These processes have been used to explained otherwise puzzling gas phase observations of simple molecules like CO in dense cores or cold H_2O in outer parts of protoplanetary disks. They are also invoked as ways to get complex organic molecules (COMs) presumably formed on grains into the gas phase. Second, photon-induced desorption of residual molecules adsorbed on the cryogenic parts of accelerators such as the LHC can be a limiting factor for their vacuum performances. Desorption rates and mechanisms, especially in the sub-monolayer regime, can therefore be of particular interest in this case.

I will present an approach to study PSD of condensed films of molecules of astrophysical interest at cryogenic temperatures, using synchrotron radiation. Recent results obtained in the VUV and soft X-ray ranges will be presented. In the VUV, we will focus on the PSD from Amorphous Solid Water (ASW) and discuss experimental results evidencing two major desorption mechanisms [1], [2]. Quantitative desorption yields from acetonitrile CH_3CN in pure and mixed samples will be also presented [3]. In the soft X-ray range, results obtained at the K-edge of Oxygen atoms will be discussed in the context of protoplanetary disks, first in the case of pure H_2O [4], CO [5], CH_3OH [6] samples and secondly in the case H_2O-rich and CO-rich samples containing CH_3OH [7].

References

[1] J.-H Fillion, R. Dupuy, G. Féraud, C. Romanzin, L. Philippe, T. Putaud, V. Baglin, R. Cimino, P. Marie-Jeanne, P Jeseck, X. Michaut & M. Bertin. ACS : Earth and Space Chemistry, 2021 *under review*

[2] R. Dupuy; M. Bertin, G. Féraud, X. Michaut, P. Marie-Jeanne, P. Jeseck, L. Philippe, V. Baglin, R. Cimino, C. Romanzin, J.-H. Fillion, PRL 2021, 126, 156001.

[3] R. Basalgete , A. Jesus Ocana , G. Féraud , C. Romanzin, L. Philippe ,X. Michaut , J.-H. Fillion & M. Bertin APJ, 2021, ApJ *accepted for publication.*

[4] R. Dupuy, M. Bertin, G. Féraud, M. Hassenfratz, X. Michaut, T. Putaud, L. Philippe, P. Jeseck, M. Angelucci, R. Cimino, V. Baglin, C. Romanzin & J.-H. Fillion, Nature Astronomy 2018, 2, 796.

[5] R. Dupuy, M. Bertin, G. Féraud, C. Romanzin, T. Putaud, L. Philippe, X. Michaut, P. Jeseck, R. Cimino, V. Baglin & J.-H. Fillion, 2021 PCCP, 23, 15965

[6] R. Basalgète, R. Dupuy, G. Féraud, C. Romanzin, L. Philippe, X. Michaut, J. Michoud, L. Amiaud, A. Lafosse, J.-H. Fillion & M. Bertin, 2021 A&A 647, A35

[7] R. Basalgète, R. Dupuy, G. Féraud, C. Romanzin, L. Philippe, X. Michaut, J. Michoud, L. Amiaud, A. Lafosse, J.-H. Fillion & M. Bertin, 2021 A&A 647, A36