Photon stimulated desorption from molecular condensates in space and laboratory

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Photon Stimulated Desorption (PSD) processes play a key role in the exchanges between the gas phase and the icy solid phase 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 H2O 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 astrophysiscal interest at cryogenic temperatures, using synchrotron radiation. Results obtained in the VUV and soft X-ray ranges will be presented. The case of simple molecules such as CO, N2 H2O will be first considered with the aim to identify molecular mechanisms. There are common points and differences between the ways particles bring energy to the ice and induce desorption. Recent results obtained on small organics (CH3OH, CH3CN) will be also briefly discussed.