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VUV photodesorption from interstellar ices analogues: Energy, flux and fluence effects on the photodesorption yields from CO2 ices

Detection of several molecules in the gas phase in the coldest regions of the interstellar medium, ISM (molecular clouds, protoplanetary disks···), has motivated intense laboratory experiments with the purpose of quantification and a better understanding of indirect desorption processes1. Condensation of gas-phase atoms and molecules on the surface of cold dust grains in these regions are known to form an icy mantle rich in molecular compounds which are trapped in the solid phase. The thermal desorption being negligible in these regions, there must be non-thermal desorption processes at play to explain actual gas phase abundances. Despite its potential central role in the gas-to-ice abundance ratio, some aspects of the photodesorption are still poorly understood or constrained. Here we have investigated the photodesorption from solid CO2 at 15K under different flux, energy and fluence conditions in order to get more insights on its photodesorption mechanism, which was before only partially understood2.

Experiments were carried out in the UHV chamber SPICES coupled to the beamline DESIRS in the VUV range (7-14eV) at the synchrotron facility SOLEIL. Molecular ices of thickness of 50 ML of CO2, grown on Au substrate at 15K, were irradiated, and the amount of desorbed neutral species were measured using a quadrupole mass spectrometer. The flux conditions were varied either by selecting zero (10ˆ14-15 s-1cm-²) or first order (10ˆ12-13 s-1cm-²) of the grating of the DESIRS beamline. The study was performed at different photon energies, in order to selectively excite the studied molecules or any expected photoproduct.

We present the outcomes of these experiments performed to investigate the flux and fluence dependent photodesorption yields of photoproducted species, and discuss the relevance of such experimental measurements to the astrophysical conditions of the interstellar medium.

References
[1] Oberg et al. A&A 496 281 (2009) ; Martin-Domenech et al. A&A 584 A14 (2015)
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