UV Photon Stimulated Desorption of interstellar ices analogues

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In the colder part of the interstellar medium, non-thermal desorption, i.e. desorption triggered by energetic particles (photons, electrons, cosmic rays) impact on the ices, is seen as the major process which explains the observed gas-to-ice balance of small molecules. For some species, like CO, vacuum UV photodesorption is the proposed dominating non-thermal process in most of interstellar environments [1]. The VUV photodesorption of several pure molecular ices have been investigated in a number of studies, using broad-band H_2 discharge lamps peaking at 10.2 eV (Lyman-α) (*e.g.* [2-4]). These studies have provided an idea of the photodesorption yields of several pure species as well as empirical constraints on the underlying mechanism, but could not unveil the molecular mechanism responsible for the molecules desorptions.

Using the monochromatized vacuum UV output of the synchrotron SOLEIL, beamline DESIRS, we show that the photodesorption for CO and N_2 ices, in the 7-14 eV range, is strongly dependent on the photon energy [5]. The energy-resolved desorption spectra, as well as the use of isotopically labeled layered ices, allowed us to derive the underlying molecular mechanism. The process has been revealed to be an indirect surface mechanism, triggered by the electronic excitation of subsurface molecules, and strongly influenced by the intermolecular interactions in the ice [6].

In order to better characterize this new mechanism, we now aim at determining the internal energy of the photodesorbed species. The measurement of the internal rovibrational state of CO will be achieved using the (2+1) resonantly enhanced multiphoton ionization (REMPI) of CO via the $E\ ^1\Pi$ - $X\ ^1\Sigma^+$ transition [8]. A time of flight detector, designed to collect the ions produced close to the ice surface will be presented. This REMPI scheme will be coupled to a pulsed laser VUV beam (8.5-10.5 eV) irradiating the surface and inducing the desorption.

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