VUV photolysis of molecules in astrophysical media : Branching ratios of photodissociative channels for databases

Bérenger Gans*[1]

[1]Institut des Sciences Moléculaires d'Orsay (ISMO) – CNRS : UMR8214, Université Paris XI - Paris Sud – Université Paris-Sud 91405 Orsay cedex, France

Résumé

Vacuum Ultra-Violet (VUV) photolysis of small molecules is often a primary step in the complex photochemistry at work in many astrophysical media since it produces radical species which are very reactive. For instance, the photolysis of methane, the second most abundant species in Titan atmosphere, is induced by the VUV solar flux and plays a major role in the carbon stratospheric chemistry of this satellite. Thus, to model the chemical evolution of several astrophysical objects, experimental laboratory investigations are needed to characterise precisely the photodissociative channels which are embedded in the photochemical networks of these media.
Nevertheless, these kinds of experimental measurements are quite scarce, mainly because they require the quantification of radical species which are produced in very small amount by the VUV photolysis.

In this context, we have carried out a pump-probe experiment (VUV/VUV) coupled with a mass-spectrometry detection technique in order to study the methane photolysis. Our experimental data allowed us to extract for the first time a set of reliable branching ratios for the different photodissociative channels at two distinct excitation wavelengths (121.6 nm and 118.2 nm) [1]. Surprisingly, our results highlighted that the branching ratios are strongly wavelength-dependent. Our data have been later used in a photochemical model of Titan's atmosphere in order to study the impact of this unexpected wavelength-dependence on the simulation outputs [2].

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*Intervenant