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# Laboratory kinetics of anions and excited cations of interest for ionospheric chemistry

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## Résumé

In this contribution, we will present results from recent experiments dedicated to ion-molecule reactions of interest for the ionospheric chemistry of Titan.

Owing to the discovery of anions that are likely to belong to the C2p+1N- and C2pH- series and to the role they might play in the formation of aerosol particles responsible for the characteristic haze observed on Titan, experimental efforts concerning the negative ion chemistry of these species have recently been made. The reaction of CN- with cyanoacetylene (HC3N) has in particular received much interest [1-4]. Room-temperature and low-temperature rate constants for this reaction have been measured by Le Picard and coworkers [1,2]. Here, we report on complementary measurements of kinetic rate constants carried out at room temperature by means of a FT-ICR spectrometer: the MICRA setup. In addition to the CN- + HC3N reaction, reactions of C3N- and C315N- with respectively HC3N and HC315N have been studied. Several mechanisms including fast proton transfer have been identified and will be discussed. Further experiments on these systems will focus on the determination of absolute reaction cross-sections and product velocity distributions as a function of collision energy using our Guided Ion Beam apparatus: CERISES in order to gain more insights into the chemical processes at stake.

New results on the reactivity of the methyl carbocation obtained with the CERISES setup will also be presented. The reactivity of CH3+ is well-known, yet the corresponding literature mainly concerns the cation in its ground state although excited species are likely to be

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\*Intervenant

present in planetary atmospheres. Here, we will report on experiments where the  $\text{CH}_3^+$  ion is generated via direct photoionization of the  $\text{CH}_3\cdot$  radical by means of VUV photons delivered by the DESIRS beamline at the synchrotron SOLEIL [5]. This allows for the production of the ion within a controlled degree of internal excitation, thus opening the possibility to investigate the effect of internal degrees of freedom (vibrational, electronic) on its reactivity. Branching ratios and absolute reaction cross-sections have been obtained for the  $\text{CH}_3^+ + \text{CH}_4$  reactive system. Reaction dynamics and its dependence on the vibrational excitation of the parent-ion will be discussed. Thanks to the radical source now available on this setup, other radicals such as  $\text{C}_2\text{H}\cdot$ ,  $\text{C}_2\text{H}_3\cdot$ ,  $\text{C}_2\text{H}_5\cdot$ ... can be produced and the reactivity of their excited cations ( $\text{C}_2\text{H}^+$ ,  $\text{C}_2\text{H}_3^+$ ,  $\text{C}_2\text{H}_5^+$ ...) will also be studied in the future.

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