

Ion processes in space and planetary atmospheres

Content

Among the multitude of molecules detected in space and in the atmospheres of planets, including our own, ions have been known to play an important role [1,2]. During the processes of star formation and evolution ion reactions have been invoked as intermediate steps in the build-up of complex organic molecules (COMs) [3], which can function as missing link in the formation of prebiotic molecules. Such biomolecule precursors can be delivered to planetary surfaces by accretion as well as comet and asteroid impacts and act as starting points for the formation of the building blocks of life. In addition, a multitude of ions including protonated nitriles and other nitrogen-containing compounds have been observed by the Cassini Plasma Spectrometer (CAPS) and the Ion and Neutral Mass Spectrometer (INMS) in the atmosphere of the Kronian satellite Titan [4]. It is therefore necessary to investigate possible formation and destruction pathways of these complex species in the interstellar medium and planetary atmospheres. With increasing complexity, also isomerism of ions gains importance and the different behaviour of isomers of ions upon chemical reactions has to be studied. During the last years, ion traps and guided beam devices have been successfully employed to investigate ion-neutral processes. We investigated the chemical reactions of isomers of nitrogen-containing ions using guided beam machines and their vibrational spectra using infrared photodissociation spectroscopy in a cold ion trap. The role of these species in the build-up of COMs in the interstellar medium and planetary ionospheres is discussed.

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[3] E. Herbst, "The synthesis of large interstellar molecules" International Reviews in Physical Chemistry 36 287 (2017)

[4] V. Vuitton, V., R. V. Yelle, Anicich, V. G., "The nitrogen chemistry of Titan's upper atmosphere revealed" The Astrophysical Journal Letters 647(2), L175 (2006).

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