EXCITED STATE FORMATION IN THE DISSOCIATIVE RECOMBINATION OF HNC^+ IONS WITH THERMAL ELECTRONS.

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Dissociative recombination (DR) of molecular ions with thermal electrons often produces radiating molecular fragments. While it is straightforward to survey the resulting emission spectra, it is more difficult to obtain quantitative yields for particular electronic and vibrational states. We have deduced such yields from band intensities in recombining flowing-afterglow plasmas containing HNC^+. The first step in this work consisted of finding out which of the two isomeric ions, HCN^+ or HNC^+ is produced by the reaction Ar^++ HCN that is used to prepare the recombining ions. The reaction was studied in a separate drift-tube experiment. We found that the ionic products of this reaction (which could be either HCN^+ or HCN^+ or a mixture of both) charge-transfer only slowly with xenon. According to earlier reaction studies this indicates that HNC^+, somewhat surprisingly, is the by far dominant product of Ar^+ +HCN compared to HCN^+.

The spectroscopic measurements in the flow tube showed strong emissions of the CN (B-X) violet band around 400 nm which means that recombination of HNC^+ with electrons produces CN($B^2\Sigma$+) with a yield that we estimate to be on the order of 10 to 20%.. In addition we observe red-band emissions from the A-X transitions. One problem in this work is that the same emissions can be excited by metastable argon atoms that are known to be present in flow tube plasmas of the kind used in our experiment. Adding small amount of xenon to the flow tube was found to be effective in destroying argon metastables such that its contribution to the excitation of CN(B) could be subtracted. Quantitative recombination yields of CN(B) are then obtained by comparing the observed intensities to computer models of the plasma. At this time, only a limited set of data have been compared to computer models but we hope to be able to present credible yields at the meeting.