Branching Fractions in Dissociative recombination of NH_4^+

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The amonium ion NH_4^+ is supposed to be abundant in the lower layer of the Earth's atmosphere and present in dense interstellar clouds, too. Dissociative recombination with electrons (DR) for NH_4^+ is important as a major loss mechanism for this ion. It is also potential source of H, and NH_3 , NH_2, NH, N and H_2 molecules, that depends upon branching fractions for DR.

We have used the CRYRING heavy ion storage ring at the Manne Siegbahn Laboratory at Stockholm University to measure cross section and branching fractions for DR of NH_4^+. Ions were created in a hot-cathode-discharge ion source, pre-accelerated and then injected into the storage ring and accelerated to an energy of 5.4 MeV. In the section of the storage ring known as electron-cooler, the ion beam was merged with a beam of cold velocity-matched electrons. The ions were stored in the ring for 1.2 s before the measurements, to relax through infrared emission to the ground vibrational state. The experimental details can be found in Strömholm et al. 1996 [1].

We have found that the recombination of NH_4^+ at zero relative energy is dominated by the NH_3 +H channel (69 %). For the break-up into the NH_2 +H_2 and NH_3 + 2H we obtained 10 % and 20 %, respectively. Our result is in good agreement with the calculations of Bates (1991) [2] for branching fractions for the same ion.

Relative cross section for DR will be presented, and detailed analysis of branching fractions.

References

[1] C. Strömholm, J. Semaniak, S. Rosén, H. Danared, S. Datz, W. van der Zande, and M. Larsson, Phys. Rev. A, 54 3086 (1996)
[2] D. Bates, J. Phys. B: At. Mol. Opt. Phys, 24, 3267 (1991)