Abstract Submitted
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H_2-Assisted Ternary Recombination of H_3^+ with Electrons at 300 K[1] RAINER JOHNSEN, University of Pittsburgh, PETR DOHNAL, PETER RUBOVIC, ABEL KALOSI, MICHAL HEJDUK, RADEK PLASIL, JURAJ GLOSIK, Charles University Prague — Afterglow measurements in ionized $He/Ar/H_2$ gas mixtures at 300 K show that the recombination of H_3^+ ion with electrons is very strongly enhanced in the presence of molecular hydrogen. In the experiments the decay of H_3^+ ions was measured by near-infrared (NIR) absorption spectroscopy (SA-CRDS).[2] Rather surprisingly, the H_2-assisted three-body recombination coefficient (K_{H2} = (8.7 +/- 1.5) $\times$ 10^{-23} cm^6s^{-1}) exceeds by more than two orders of magnitude the corresponding He-assisted coefficient (K_{He} = (3.3 +/- 0.7) $\times$ 10^{-25} cm^6s^{-1}) that we measured earlier.[3] Formation of faster recombining H_5^+ cluster ions does not play a significant role at temperature near 300 K. The ternary processes are found to saturate at high He and H_2 densities, suggesting that recombination proceeds by a two-step process, electron capture (with a rate coefficient α_F = (1.5 +/- 0.1) $\times$ 10^{-7} cm^3s^{-1}) into a long-lived Rydberg state with an excited core, followed by collisional stabilization. While these findings provide a plausible explanation for some of the discrepancies between earlier afterglow measurements of H_3^+ recombination, the exact nature of these long-lived complexes, and their collisional interactions remain to be elucidated.

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[2]P. Macko et al, *Int. J. Mass Spectrom.* **233**, 299 (2004).
[3]R. Johnsen et al, *J. Phys. Chem. A* **117**, 9477 (2013).

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