

**Title:** Study of  $\text{H}_3^+$  recombination in selected quantum states  
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**Abstract:**

In this work measurement of the effective recombination rate coefficient of  $\text{H}_3^+$  dominated and recombination governed afterglow plasma at 77 K and 145 K are presented. Population of para- $\text{H}_3^+$  in the studied plasma has been varied by using para enriched  $\text{H}_2$  as a precursor along with normal  $\text{H}_2$ . Time resolved NIR-CRDS was used to in-situ measure the number density evolution of the two lowest rotational states of  $\text{H}_3^+$ . Measurements at different para to ortho  $\text{H}_3^+$  ratios, at otherwise identical conditions, allowed for extrapolation of the effective recombination rate coefficient of pure para- $\text{H}_3^+$  and ortho- $\text{H}_3^+$ . From measured dependences on the buffer gas densities the values of the recombination rate coefficients for the binary and ternary channel are determined of para- $\text{H}_3^+$  and ortho- $\text{H}_3^+$ .

**Keywords:** recombination, spectroscopy,  $\text{H}_3^+$ , para  $\text{H}_2$