

## Influence of the collision Energy on the Reaction Rate of the $D_2^+$ + $H_2O$ Ion-Molecule Reaction near 0 K

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Ion-molecule reactions are important reactions in atmospheric chemistry, astrophysics, and plasma physics.<sup>[1]</sup> Reliable values for the reaction rates are key to modelling the relevant reaction networks. This poster focusses on the reactions of water with  $D_2^+$  at the low temperatures in the range of 0-50 K of interstellar molecular clouds.<sup>[1-2]</sup> For technical reasons  $D_2^+$  is instead of  $H_2^+$ .

Because ions are easily accelerated by (stray) electric fields, high Rydberg states ( $n \approx 30$ ,  $v^+ = 0$ ,  $N^+ = 0$ ) are utilised as proxies for the ionic reaction partner, because the Rydberg-electron does not significantly affect the reaction but shields it from electric fields.<sup>[3-4]</sup> We use a merged-beam approach featuring a Rydberg-Stark deflector and decelerator to access the collision-energy range below  $k_B \cdot 10$  K. The molecular beam of water is characterised.

The reaction rates are modelled with an adiabatic capture model inspired by earlier work in Refs. [5-7] which is constructed by modifying the Langevin model with the rotational-state-specific energy of the neutral molecules in the field of the ion.<sup>[5-8]</sup> For Maxwell-Boltzmann rotational-state distributions below 100 K the model predicts an increase of the reaction-rate constant at low collision energies.

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