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.[1] 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.[1,2] For technical reasons D_2^+ is used 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.[3,4] We use a merged-beam approach featuring a Rydberg-Stark deflector and decelerator to access the collision-energy range below $k_B \cdot 10\,\mathrm{K}$. The molecular beam of water is characterised.

The reaction rates are modelled with an adiabatic capture model inspired by earlier work in Refs. [5,6,7] which is constructed by modifying the Langevin model with the rotational-state-specific energy of the neutral molecules in the field of the ion.[5,6,7,8] 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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