

Abstract

We studied how distribution of nuclear-spin states of H_3^+ ions or H_2 molecules influence rate coefficients of H_3^+ -electron recombination or reactions of H_2 with N^+ or H^+ , with regard to kinetic and internal temperatures of the reactants. Experiments were carried out in plasma environment or in an ensemble of ions in an ion trap. Main diagnostic methods were the Langmuir probe diagnostics, laser absorption- and mass spectroscopy. The distribution of nuclear spin states (para and ortho) was varied using a specially constructed para-hydrogen generator. We performed pioneer measurements of the rate coefficients for the nuclear-spin-state-selective binary and ternary H_3^+ -electron recombination in thermalised plasma. We performed studies of $\text{N}^+ + \text{para/ortho-H}_2$ reaction with high accuracy and interpreted the results as dependent on fine structure states of N^+ ions. We measured a temperature dependence of the rate coefficients for radiative and ternary channels of $\text{H}^+ + \text{para/ortho-H}_2$ association.