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Nuclear Spin Effects in the Reactions of H_3^+ with H_2 and Electrons
HOLGER KRECKEL, KYLE CRABTREE, CARRIE KAUFFMAN, BRIAN TOM, University of Illinois, OLDRICH NOVOTNY, MAX BERG, DENNIS BING, HENRIK BUHR, CLAUDE KRANTZ, MICHAEL LESTINSKY, MARIO MENDES, CHRISTIAN NORDHORN, JULIA STUTZEL, ANDREAS WOLF, MPI-K Heidelberg, RICHARD THOMAS, University of Stockholm, BENJAMIN MCCALL, University of Illinois — H_3^+ is the simplest polyatomic molecule. It is widely used as a benchmark for theoretical calculations of molecular spectroscopy and reaction dynamics, and also plays a pivotal role as the cornerstone of interstellar chemistry. In Urbana, we have investigated the proton hop/exchange reaction $H_3^+ + H_2 \rightarrow (H_5^+)^* \rightarrow H_2 + H_3^+$ for the first time at low temperatures. This reaction is the simplest bimolecular reaction involving a polyatomic, and is also the most common bimolecular reaction in the universe. Our experiments have revealed the branching ratio between proton hop and exchange, and appear to explain the observed *ortho:para* ratio of H_3^+ in diffuse interstellar clouds. At the TSR storage ring of the Max Planck Institute for Nuclear Physics in Heidelberg, we have performed high-resolution measurements of the dissociative recombination (DR) cross sections of cold H_3^+ in different mixtures of its lowest *ortho* and *para* quantum states. These measurements represent an important step towards the first state-selected DR measurements.

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