

# Chemical Reaction Dynamics of Highly Vibrationally Excited Molecular Ions

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Ion beams of  $\text{H}_2^+$  in selected rovibrational states were produced using a novel high-resolution pulsed-field ionization–coincidence approach that substantially extends the range and selectivity of accessible molecular ion states. Reaction cross sections of the  $\text{H}_2^+ + \text{Ne}$  proton transfer reaction were measured for vibrational quantum levels ranging from  $v^+ = 1$  to 13 at a translational energy of 1.2 eV. The results are compared with quasi-classical trajectory (QCT) calculations. The QCT proton transfer cross sections are approximately a factor 2 lower than the observed cross sections from  $v^+ = 1$  to 10. The discrepancy increases at higher vibrational levels where dissociation competes effectively with ion-molecule reaction.

This work was supported by the U.S. Department of Energy and the U.S. Air Force.

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