CHEMICAL PROBING SPECTROSCOPY OF H_3^+ IN A CRYOGENIC RADIOFREQUENCY TRAP

HOLGER KRECKEL[a], DENNIS BING, SASCHA REINHARDT, ANNEMIEKE PETRIGNANI, MAX BERG, and ANDREAS WOLF, *Max-Planck-Institut für Kernpysik, Saupfercheckweg 1, 69117 Heidelberg, Germany*.

The H_3^+ molecular ion is a key species for the chemistry of the interstellar medium. Being the simplest polyatomic ion it also serves as a benchmark system for quantum chemistry calculations. Due to the absence of a permanent dipole moment and since no stable electronically excited states are known, spectroscopy is restricted to vibrational transitions in the infrared. To date more than 800 transitions covering states up to 13 600 cm^{-1} above the ground state have been observed. Nevertheless, for a better understanding of H_3^+ dissociation and dynamics, it is necessary to extend that range considerably towards the dissociation limit of 35 000 cm^{-1}. We have developed a chemical probing technique that is able to probe high-lying H_3^+ states with unprecedented sensitivity[b]. The H_3^+ ions are buffer-gas cooled in a radiofreqeuncy ion trap at 55 K. Argon is let in as a probe gas and laser transitions between 11 330 and 13 300 cm^{-1} trigger the formation of ArH^+ ions which are detected by a quadrupole mass spectrometer. Here, we report the detection of the weakest H_3^+ transitions observed to date and discuss the possible extension of the scheme into visible wavelengths and beyond.

---

[a] present address: Department of Chemistry, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801, USA

[b] H. Kreckel, D. Bing, S. Reinhardt, A. Petrignani, Max Berg, and A. Wolf, J. Chem. Phys. 129, 164312 (2008)