

IR SPECTRA OF COLD PROTONATED METHANE

OSKAR ASVANY, *I. Physikalisches Institut, Universität zu Köln, Köln, Germany*; KOICHI MT YAMADA, *EMTech, National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Japan*; SANDRA BRÜNKEN, ALEXEY POTAPOV, STEPHAN SCHLEMMER, *I. Physikalisches Institut, Universität zu Köln, Köln, Germany*.

High-resolution infrared spectra of mass selected protonated methane, CH_5^+ , have been recorded in the C-H stretching region in a 22-pole ion trap experiment at low temperatures. The frequencies of the infrared OPO system (pump and signal) have been calibrated using a NIR frequency comb. As a result the ro-vibrational IR transition frequencies of CH_5^+ could be determined to an accuracy in the MHz regime.^a In this contribution we discuss different techniques of laser induced reactions which enabled recording spectra at different temperatures.^b The spectra simplify dramatically at a nominal trap temperature of 4 K. Nevertheless an assignment of these spectra is very difficult. We apply the idea of the Rydberg-Ritz combination principle to the complex spectra of protonated methane in order to get first hints at the energy level structure of this enigmatic molecule.

^aO. Asvany, J. Krieg, and S. Schlemmer, Frequency comb assisted mid-infrared spectroscopy of cold molecular ions, *Review of Scientific Instruments*, 83 (2012), 076102.

^bO. Asvany, S. Brünken, L. Kluge, and S. Schlemmer, COLTRAP: a 22-pole ion trapping machine for spectroscopy at 4 K, *Applied Physics B: Lasers and Optics*, 114 (2014), 203-211