JET COOLED MOLECULAR IONS IN SLIT SUPERSONIC DISCHARGES: HIGH RESOLUTION INFRARED STUDIES OF HYDRONIUM ION ISOTOPOMERS IN THE OD STRETCH REGION

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Jet-cooled high-resolution infrared spectra in the O-D stretch region of partially deuterated hydronium ion isotopomers (e.g., HD_2O^+, H_2DO^+) are obtained for the first time, exploiting the high ion densities, long absorption path lengths, and concentration modulation capabilities of slit jet discharge methods. The spectra are obtained with a new cw difference frequency mixing spectrometer, based on non-linear subtraction of a fixed frequency single mode Nd:YAG source and a scanning single mode Ti:Sapphire laser in periodically poled lithium niobate, which delivers many tens of microwatts in the required 2550-2650 cm^{-1} region. Least-square analysis with a Watson asymmetric top Hamiltonian yields band origins and vibrationally excited rovibrational constants, providing rigorous tests of ab initio potential surface predictions from Rajamaki et al., J. Chem. Phys. 118, 10929 (2003) and Huang et al., J. Chem. Phys. 118, 5431 (2003)).