

HIGH-RESOLUTION INFRARED SPECTRA OF THE OH-STRETCHING BANDS OF PROTONATED WATER DIMER, H_5O_2^+

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We present high-resolution infrared action spectra of cold H_5O_2^+ . For this purpose the mass selected parent ions are stored in a cryogenically cooled 22-pole ion-trap (COLtrap). There we employ a two-color-photodissociation scheme where first the symmetric or the anti-symmetric O-H-stretching band is excited by a narrow linewidth cw-OPO. Then, Light from a CO_2 laser is used to efficiently dissociate the parent molecule. The infrared-absorption of the parent ion is recorded by the appearance of H_3O^+ photoproducts. This procedure follows the seminal approach first invented in the group of Y.T. Lee ^{a,b}. The rotationally resolved and basically background-free spectrum exhibits a complex structure, making the assignment of individual ro-vibrational tunneling features challenging. Nonetheless, recurring spectral spacings are used to start to unfold the rotational/tunneling structure. Moreover, spectral indicators are found that support the assumption of hydrazine-like tunnelling dynamics being present in this peculiar molecule of fundamental interest.

^a L. I. Yeh, M. Okumura, J. D. Myers, J. M. Price, and Y. T. Lee, *Vibrational spectroscopy of the hydrated hydronium cluster ions $\text{H}_3\text{O}^+(\text{H}_2\text{O})_n$ ($n=1,2,3$)*, *J. Chem. Phys.* 91, 7319-7330 (1989)

^b L. I. Yeh, Y. T. Lee, and J. T. Hougen. *Vibration-rotation spectroscopy of the hydrated hydronium ions H_5O_2^+ and H_9O_4^+* . *Journal of Molecular Spectroscopy* 164.2 (1994): 473-488.