OVERTONE VIBRATIONAL SPECTROSCOPY AND DYNAMICS IN H_2-H_2O COMPLEXES: A COMBINED THEORETICAL AND EXPERIMENTAL STUDY

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We present spectroscopic studies on the H_2-H_2O complex, providing information on the binding of these astrochemically-significant molecules. Understanding this interaction is crucial for further understanding the production of H_2 from atomic hydrogen on interstellar dust grain surfaces, which are often covered with an icy mantel. We generate these clusters using a slit supersonic jet expansion which cools to below 5 K, a temperature which is sufficiently low for observing this species whose binding energy is 60 cm^{-1}. The experimental detection method consists of an infrared vibrational excitation followed by a 193 nm pulse to photolyze H_2O and laser induced fluorescence on the OH product. In conjunction with theoretical studies presented in the accompanying talk, we identify two overtone bands associated with excitation of the $|02-\rangle \leftarrow |00+\rangle$ transition in the water moiety. Theory and experiment agree to within 0.2 cm^{-1}, which attests to the accuracy of the method used to make predictions, as shown in the accompanying talk. Additional time and frequency domain measurements are performed with this three laser experiment to obtain information on predissociation dynamics, where internal H_2O vibration is transferred to the intermolecular coordinate. Theoretically-generated excited state wavefunctions are used to obtain further insight into the significant dependence of predissociation lifetime on the upper state in the infrared cluster transition.