INFRARED PHOTODISSOCIATION SPECTROSCOPY OF SMALL, MASS-SELECTED PROTONATED WATER CLUSTERS

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$H^+(H_2O)_n$ and $H^+(H_2O)_nAr_m$ complexes are produced in a laser vaporization pulsed nozzle source, mass-selected, and studied by infrared photodissociation spectroscopy. Photofragment yields are measured as a function of energy in the region near the symmetric and asymmetric stretching vibrations of water (3657 cm^{-1}, 3756 cm^{-1}). Dissociation occurs by the loss of intact water molecules in the pure complexes. The argon-tagged complexes fragment by the loss of Ar, producing larger fragment yields and sharper spectra than the corresponding pure clusters. The spectra of the smaller complexes (n=1-8) are compared to theory and previous experiments. At larger cluster sizes, the spectra simplify to a closely spaced doublet at the center of the O-H region (3700 cm^{-1}) and a broad feature in the hydrogen bonded region. It is concluded that at a specific cluster size (n=10), most of the water molecules are included in the hydrogen bonded network, giving rise to only one type of O-H stretch.