RESONANT ION DIP INFRARED SPECTROSCOPY (RIDIRS) OF BENZENE-(METHANOL)$_m$ HYDROGEN-BONDED CLUSTERS

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Infrared spectra of benzene-(methanol)$_m$ clusters formed in a jet-cooled molecular beam are recorded in the methanol ν_1 O-H stretch region (3100 to 3800 cm^{-1}). RIDIRS utilizes Resonant 2-Photon Ionization Time-of-Flight Mass Spectroscopy (R2PI-TOFMS) to monitor a size selected cluster's ion signal which is proportional to its neutral ground state population. The tunable infrared output of a Nd:YAG-pumped OPO system is spatially overlapped with the R2PI near-UV pulsed laser beam and precedes it by 80 ns. When in resonance with an infrared transition, population is removed from the cluster's neutral ground state prior to ionization, producing a dip in the R2PI ion signal. Experimental hydrogen-bond vibrational signatures (i.e. vibrational frequency shifts and changes in band widths), along with ab initio calculations, provide structural information about each cluster. Chain structures exist for benzene-(methanol)$_{1-3}$, and methanol cyclic structures are attached to benzene in benzene-(methanol)$_{4-6}$.