INFRARED STUDY OF HCL CLUSTERS IN HELIUM DROPLETS

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The results of the joint theoretical and infrared laser spectroscopic study of the hydrogen chloride monomer and clusters, $(HCl)_n$ (n = 1-6), isolated in helium nanodroplets are presented. The H-Cl stretching bands of the dimers and trimers show a large increase in the band intensity as well as low frequency shift with respect to that in a single HCl molecule. The average frequency of the bands for clusters larger than trimers remains approximately constant, which correlates well with the onset of the folded cyclic structure and the full development of the hydrogen bonding in larger clusters. In addition, the interchange-tunneling splitting in the vibrationally excited state of the bonded H-Cl stretching band ν_2 in ($H^{35}Cl$ - $H^{37}Cl$) dimers of 2.7±0.2 cm^{-1} was measured, as compared to 3.7 cm^{-1} in free dimer. From the splitting, the strength of the interchange-tunneling interaction in liquid helium of 0.85±0.15 cm^{-1} was obtained, which is about a factor of two smaller than in the free dimer.