Double Resonance Study of Hydrogen-Bonded Perylene Complexes

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Spectral hole-burning has been performed on different aggregate levels of the hydrogen-bonding species perylene/water, perylene/methanol, etc.. This and other spectroscopic techniques are used in order to examine how a hydrophobic molecule such as perylene affects the formation of hydrogen-bonded clusters through the study of low-frequency modes and cluster dynamics. Several features have been resolved showing red shifted excitation frequencies relative to the bare parent molecule, as well as slightly blue shifted frequencies, as for example, in the case of the water complex. Low frequency mode structure is superimposed on the strong vibronic resonances of the complex, suggesting the possibility of a tumbling motion on the perylene plane. In order to elucidate the structure of some of the less facile species, rotational coherence spectroscopy is performed, resulting in the proposal of several possible structures. Picosecond time-resolved fluorescence spectroscopy, as well as dispersed fluorescence spectroscopy, is also performed in order to characterize the presence of any excited state relaxation pathways at the zero point and higher vibronic levels.