Molecular Structure and Weak Interactions Explored by Broadband Microwave Spectroscopy

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Microwave spectroscopy allows details of structure to be measured for molecules and complexes which are isolated in the gas phase. One aim is to quantify weak interactions with high selectivity such that intrinsic character can be separated from effects of a solvent or matrix. This theme will be illustrated through recent studies of molecules containing imidazole. It will be shown that two isomers of a complex formed between this molecule and water can be isolated and spectroscopically-characterised in the gas phase. A second aim is to explore the gas phase chemistry prompted by laser vaporisation of solids in the presence of a mixture of chemical precursors, a process known to allow the generation of small molecules that can be found in interstellar and circumstellar environments. Laser vaporisation of platinum in the presence of gaseous hydrocarbons allows very efficient generation of PtC_3, an atypical and exotic platinum carbene which has structural similarities with the oxycarbon species, OC_3. Experiments are performed using a unique broadband rotational spectrometer that allows the simultaneous observation of many rotational transitions across a broad bandwidth.