SYHR 2: High resolution spectroscopy - modern trends and new techniques II

Zeit: Donnerstag 14:00–16:00 Raum: VMP 8 R05

Hauptvortrag SYHR 2.1 Do 14:00 VMP 8 R05

Microwave Spectroscopy of Weakly Bound Systems and Floppy Molecules — •Wolfgang Stahl — Institute of Physical Chemistry, RWTH Aachen University, 52056 Aachen, Germany

FT microwave spectroscopy using molecular beams is an excellent tool to study weakly bound systems like rare gas clusters and hydrogen bonded systems. Here the molecular beam conditions are necessary to form these species and the inherently high resolution of FT microwave spectroscopy allows to accurately determine their structure and dynamics. However, experimental and also theoretical limitations exist. Experimentally, the rather low sensitivity of FT microwave spectroscopy compared to other methods is probably a bigger problem than resolution. The biggest theoretical limitation is currently the proper treatment of large amplitude motions which are almost always present in weakly bound systems but also in stable molecules. Here in recent years some progress has been made, however, due to the multidimensional potentials found in many weakly bound systems assignment of the spectra is difficult and sometimes impossible. In many cases only fundamental states have been analyzed but also many observed transitions remain unassigned. Including these lines which often are due to higher tunneling states would provide a source for parameters describing the potential surface.

Some examples for solved and yet unsolved problems with weakly bound systems and floppy molecules will be discussed.

Hauptvortrag SYHR 2.2 Do 14:40 VMP 8 R05

Rovibrational spectroscopy on cold trapped molecular ions below 0.1 K — •Bernhard Roth — Institut für Experimentalphysik, Heinrich-Heine Universität Düsseldorf, 40225 Düsseldorf

Molecular hydrogen ions (H_2^+, HD^+, ...), the simplest molecules in nature, are interesting systems for fundamental tests of physics and for methodological quantum-optical studies. Their three-body nature also makes them benchmark systems for quantum theoretical calculations.

One interesting aspect is the dependence of vibrational and rotational energies in molecular hydrogen ions on certain fundamental constants, e.g. m_e/m_p, m_p/m_d, or m_p/m_t. Significant theoretical advances now permit to calculate these energies ab-initio with an inacccuracy below 1 part in 10^9, including important contributions from relativistic and QED corrections. High-resolution spectroscopic measurements of energy differences between those levels can be combined with precise theoretical calculations to obtain improved values for m_e/m_p and m_p/m_d, for example. The dependence of the transition energies on the particle mass ratios makes these molecules also interesting candidates for a laboratory search for a possible time-variation of these constants.

In this talk I will describe the status of the Düsseldorf experiment on precision laser spectroscopy of sympathetically cooled HD^+ ions, including the most recent developments towards enhanced precision.

Hauptvortrag SYHR 2.3 Do 15:20 VMP 8 R05

Eigenstate-resolved electronic spectroscopy of large molecules in the gas phase. — •David W. Pratt — University of Pittsburgh, Pittsburgh PA USA

Remarkable progress has been made in the last few years in determining both the structural and dynamical properties of large polyatomic molecules and their clusters in the gas phase, and how these change when the photon is absorbed, using high resolution CW lasers operating in the UV, molecular beam machines, and rapid data analysis methods. Following a brief description of these methods, this talk will describe recent applications of this technique to several systems in which significant charge redistribution accompanies the excitation process, including hydrogen-bonded water complexes, base pairs and their mimics, and other molecules of importance to biology. These applications include studies of such spectra in the presence of applied electric fields, yielding conformer-specific values of the electric dipole moments in both electronic states.

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