SYCM 1 Heteronuclear cold molecules

Zeit: Samstag 11:15–13:15 Raum: HU Audimax

Hauptvortrag SYCM 1.1 Sa 11:15 HU Audimax

Molecular Spectroscopy as a Probe of Quantum Solvation — •R. E. Miller — Department of Chemistry, University of North Carolina, Chapel Hill NC 27599

Helium nanodroplets are being used to study quantum mechanical exchange in a finite system. These dynamical processes are probed by doping the droplets with a molecule, the spectroscopy of which is sensitive to the quantum solvent environment. Infrared laser spectroscopy is found to be an ideal method for probing the associated dynamics, providing detailed information on the rotational and vibrational motion of the solvated molecules and the nature of the coupling of these to the solvent. These nanodroplets also provide us with a unique method for forming clusters and nanoparticles with unique structures, resulting from the low temperature growth. A number of applications of this type will be discussed.

Hauptvortrag SYCM 1.2 Sa 11:45 HU Audimax

Synthese und Charakterisierung von Molekülen in Helium-Nanotröpfchen — •F. Stienkemeier[1], O. Bünermann[1], M. Mudrich[2] und M. Weidemüller[2] — [1]Fakultät für Physik, Universität Bielefeld, Universitätsstr. 25, 33615 Bielefeld — [2]Physikalisches Institut, Albert-Ludwigs-Universität Freiburg, Hermann-Herder-Straße 3, 79104 Freiburg

Durch Isolation von Atomen und Molekülen in Helium-Nanotröpfchen lassen sich spektroskopische Untersuchungen bei Temperaturen im Millikelvin-Bereich durchführen. Insbesondere erlaubt das sukzessives Beladen von einem Tröpfchen mit verschiedenen Atomen oder Molekülen die Synthese genau definierter Aggregate in der kalten Umgebung. Dies sind in unseren Experimenten zum einen hetero-nukleare Alkalimoleküle und -cluster [1], zum anderen halbleitende organische Nanostrukturen [2]. Bei Alkalimolekülen erhalten wir durch Laseranregung elektronischer Übergänge detailierte Informationen über Wechselwirkungspotentiale. Andererseits lassen sich bei den organischen Systemen aber auch exzitonische Übergänge anregen und so Ladungstransfereigenschaften in größenbegrenzten Aggregaten studieren.

[1] Marcel Mudrich, Oliver Bünermann, Frank Stienkemeier, Olivier Dulieu,and Matthias Weidemüller, Eur. Phys. J. D (in press).
[2] M. Wewer and F. Stienkemeier, Phys. Rev. B 67, 125201 (2003); J. Chem. Phys. 120(3), 1239 (2004).

Hauptvortrag SYCM 1.3 Sa 12:15 HU Audimax

Spectroscopic tools for forming cold mixed alkali dimers — •Eberhard Tiemann[1], Asen Pashov[2], Ruvin Ferber[3], Maris Tamanis[3], Olga Docenko[3], and Lena Zaharova[3] — [1]Universität Hannover, Institut für Quantenoptik — [2]Institute for Scientific Research in Telecommunications, Sofia/Bulgarien — [3]University of Latvia, Riga/LV

Up to now four different ways for obtaining ensembles of cold polar molecules are proposed and applied: photoassociation, Feshbach resonances, deceleration or selection of molecules with low translation energy by inhomogeneous electric fields and buffer gas cooling.

For a quantitative description of these processes a large amount of detailed spectroscopic data is needed which was not obtained in earlier work because its goal was concentrated on systematics of molecular structures.

We will open the view how to obtain needed molecular data for the regime of cold collisions and their resonance structure, of weakly bound systems and for transfer processes to long living states.

This should also give the base for the discussion of new applications of cold ensembles of polar molecules.

Hauptvortrag SYCM 1.4 Sa 12:45 HU Audimax

Manipulation of polar molecules with electric fields — •Gerard Meijer — Fritz-Haber-Institut der Max-Planck-Gesellschaft, Faradayweg 4-6, Berlin, Germany

In this presentation I will give an overview of the various experiments that we have performed during the last few years to explore the possibilities of manipulating neutral polar molecules with electric fields. Arrays of time-varying, inhomogeneous electric fields have been used to reduce in a stepwise fashion the forward velocity of molecules in a beam. With this so-called 'Stark decelerator', the equivalent of a LINear ACcelerator (LINAC) for charged particles, one can transfer the high phase-space density that is present in the moving frame of a pulsed molecular beam to a reference frame at any desired velocity; molecular beams with a computer-controlled (calibrated) velocity and with a narrow velocity distribution, corresponding to sub-mK longitudinal temperatures, can be produced. These decelerated beams offer new possibilities for collision studies, for instance, and enable spectroscopic studies with an improved spectral resolution. These decelerated beams have been used to load ND_3 molecules and OH radicals in an electrostatic trap at a density of (better than) 10^7 mol/cm^3 and at temperatures of around 50 mK. Ground-state ND_3 molecules have been trapped in a novel AC electric field trap, slow beams of ND_3 molecules have been injected in an electrostatic storage ring, and, using microstructured electrode arrays, a switchable mirror for neutral molecules has been constructed and tested. The variety of schemes that we are pursuing to further increase the phase-space density of the trapped molecules will be discussed.