MO 10: Poster: Spectroscopy in He Droplets

Time: Tuesday 16:00–18:30 Location: Lichthof

MO 10.1 Tu 16:00 Lichthof

Doping of helium nanodroplets from an alkali metal dispenser source — •Matthew Sievert, Barbara Grüner, Christian Giese, Lutz Fechner, Marcel Mudrich, and Frank Stiekemeier — Physikalisches Institut, Universität Freiburg, Germany

Helium nanodroplets have been employed as cryostats for molecules and clusters and therefore allow high resolution molecular spectroscopy. In studies of alkali metals, the droplets are doped when passing a heated cell providing a high vapor pressure of the required alkali atoms. Picking-up more than one alkali atom leads to subsequent formation of molecules on the surface of the helium nanodroplets. As an alternative to the widely used thermal evaporation in heated oven cells we are developing a dispenser device which provides higher flexibility: in one small device multiple alkali sources can be stored and activated in any combination. Moreover, handling and out-of-vacuum storage of dispensers is far less complex when compared to bulk alkali metals.

MO 10.2 Tu 16:00 Lichthof

Time-of-flight and velocity-map-imaging detectors for femtosecond pump-probe experiments in helium nanodroplets — •Lutz Fechner, Marcel Mudrich, and Frank Stienkemeier — Physikalisches Institut, Universität Freiburg, 79104 Freiburg, Germany

A time-of-flight as well as a velocity-map-imaging detector are developed for photoionization spectroscopy of molecules attached to helium nanodroplets. Upon ionization the formed molecular ions either leave the helium droplet or remain inside. The latter results in an object of very small charge-to-mass ratio. We present a new time-of-flight detector design that covers the mass range from 1 up to 10^5 amu even with ion extraction perpendicular to the molecular beam axis.

The new velocity-map-imaging detector is optimized for achieving high photoelectron energy resolution using a simple design. Photoelectron spectroscopy as well as ion-imaging in combination with femtosecond pump-probe photoionization will open a variety of new experiments including wave-packet dynamics of molecules embedded inside helium nanodroplets.

MO 10.3 Tu 16:00 Lichthof

A phenomenological model for molecular dynamics on helium nanodroplets — •Martin Schlesinger[1], Walter T. Strunz[1], Marcel Mudrich[2], and Frank Stienkemeier[2] — [1]Institut für Theoretische Physik, TU Dresden, 01062 Dresden — [2]Physikalisches Institut, Universität Freiburg, 79104 Freiburg

Superfluid helium nanodroplets serve as an an ideal "refrigerator" for high precision spectroscopy of embedded species. Recent experiments study vibrational dynamics of dimers attached to helium nanodroplets, employing femtosecond pump-probe spectroscopy [1]. Numerical calculations include a general damping of vibrational wave packets as well as desorption of dimers off the droplet [2]. While this model is sufficient to describe experimental findings in spin singlet systems, it may fail for other species attached to the droplets. We therefore extend our model and allow for decoherence mechanisms of different dimer degrees of freedom.

[1] P. Claas, G. Droppelmann, C. P. Schulz, M. Mudrich, and F. Stienkemeier, J. Phys. B: At. Mol. Opt. Phys. **39**, 1151 (2006).
[2] M. Schlesinger, M. Mudrich, F. Stienkemeier, and W. T. Strunz, arXiv:0909.4691v1

MO 10.4 Tu 16:00 Lichthof

IR-spectroscopy of glycine and its complexes with water in liquid He nanodroplets — •Melanie Letzner, Susanne Dohe, Gerhard Schwaab, and Martina Havenith — Department of Physical Chemistry II, Ruhr Universität Bochum, Germany

Glycine is the smallest amino acid, and therefore it is of special interest as a model and starting point for theoretical and experimental studies. Whereas the crystalline form of glycine consists of zwitterions, gas phase glycine is known to exist in the nonionized form. The interaction between glycine and water has been widely studied using a large variety of theoretical methods. Depending on the theoretical level used, a stabilisation of the zwitterionic form is predicted for complexes containing from 2 to 7 water molecules. In low-temperature Ar matrices a set of characteristic IR absorption bands for the zwitterionic form has been observed. The higher stoichiometry complexes (glycine).$(H_2O)_n$ with n larger than 3 are demonstrated to be zwitterionic H-bonded complexes. The multitude of conformations expected for these glycine-water complexes makes a combination of low temperature and high resolution spectroscopy essential. We want to use the advantages of our experiment to investigate glycine and its complexes with water in helium-nanodroplets at ultracold temperatures in the range from 3000-3800 cm^{-1}. Our measurements were carried out using a high power IR-OPO (cw: 2.7 W) as radiation source and a heliumcluster spectrometer. Helium-nanodroplets are formed by expansion of helium at 55 bar through a 5 μm nozzle which is kept at temperatures of 16 K. The status of the project is presented.

MO 10.5 Tu 16:00 Lichthof

Excitation spectroscopy of alkaline earth ion doped helium nanodroplets — •Raphael Katzy, Severin Müller, Marcel Mudrich, and Frank Stienkemeier — Physikalisches Institut, Universität Freiburg

In recent years helium nanodroplets have been successfully established as matrix for spectroscopy of atoms and molecules. In superfluid droplets particles are isolated and cooled down to the scale of millikelvin.

In our experiments we dope the droplets with singly charged alkaline earth ions using kHz laser ablation. Excitation spectra of the ions are recorded using laser-induced flourescence.

Ions bind nearby helium atoms tightly due to interaction with induced dipoles. A layered structure of high density emerges which is called snowball. On the other hand in the case of alkaline earth ions the left-over valence electron causes Pauli exchange repulsion. If this force is dominant an area of vanishing helium density is induced around the ion, a so called bubble.

To find out which of these counteracting mechanisms dominates LIF spectra are taken.