MO 8: Poster: Spectroscopy in He Droplets

Time: Monday 16:00–18:00 Location: P1

MO 8.1 Mon 16:00 P1

IR-Spectroscopy of HCl with water in liquid Helium nanodroplets — •Melanie Letzner, Daniel Habig, Torsten Poerschke, Sarah Grün, Pablo Nieto, Kenny Hanke, Gerhard Schwaab, and Martina Havenith — Department of Physical Chemistry II, Ruhr Universität Bochum, Germany

We investigated aggregates of HCl and H_2O at ultracold temperatures in helium nanodroplets which provide a gentle, ultracold matrix for studies of aggregation and solvation processes. Helium nanodroplets are formed by expansion of helium at 55 bar through a 5 μm nozzle which is kept at a temperature of 18 K. Under these conditions clusters with an average size of 8000 atoms are formed. Measurements were carried out using a high power IR-OPO (cw: 1.8 W) as radiation source. Depletion spectra of the super cooled aggregates (0.37 K) were recorded between 2650 cm^{-1} and 3300 cm^{-1}. We observed spectral features of $(HCl)_m(H_2O)_n$ aggregates in the region of the H_3O^+ stretch vibration. The observed pressure dependence of the signals in combination with optically selective mass spectroscopy (OSMS) and pick up curves allowed assignment of the signals. We observed IR spectra of the dissociated HCl-water cluster.

MO 8.2 Mon 16:00 P1

Doping of helium nanodroplets with an ionic liquid — •Kenny Hanke, Torsten Poerschke, Gerhard Schwaab, and Martina Havenith — Department of Physical Chemistry 2, Ruhr-Uni-Bochum, Germany

Helium nanodroplets provide an ultracold but very soft matrix for the IR-spectroscopy of single molecules and small clusters. Therefore we have constructed a modular helium cluster machine with differentially pumped chambers. In the first chamber precooled gaseous helium is expended through a 5 μm nozzle into vacuum. The formed helium cluster beam can be adjusted to different average cluster sizes via the nozzle temperature (11-20 K) and helium pressure (20-70 bar). Two inlets for gaseous or liquid reactants are provided in the second chamber. The partial pressure of the components can be controlled by electrical regulating valves and a residual gas analyzer attached to the chamber. Liquids with a high vapor pressure and solids can be evaporated with an oven in the third chamber. The flow and composition of the helium beam is detected with a quadrupol mass spectrometer in the last chamber. A laser can be coupled in for infrared spectroscopy.

To prove the efficiency of the machine an ionic liquid, which are known for their low vapor pressure, has already successfully been evaporated and embedded in the helium cluster beam.

MO 8.3 Mon 16:00 P1

High Resolution IR-Spectroscopy of HCl-H_2O-Clusters in Helium-Nanodroplets — •Sarah Angelique Grün, Gerhard Schwaab, and Martina Havenith — Ruhr-Universität-Bochum, Bochum, Deutschland

We have studied the microsolvation of HCl in helium nanodroplets via high−resolution infrared (IR) spectroscopy using the Bochum He−nanodroplet apparatus in combination with a home−built cw−Optical Parametric Oscillator (OPO) with full frequency coverage in the range from 2600−3200 cm^{-1}, high output power (up to 2.7 W), and high resolution (0.0001 cm^{-1}).

After formation the helium nanodroplets were doped successively with HCl and H_2O in a differentially pumped pickup chamber. The average number of embedded molecules depends on the partial pressures in the pickup chamber which were in a range up to 2.0 mPa. In order to assign spectroscopic signals to a special species we have carried out mass selective measurements to record the change in the intensity of the depletion signal in dependence of the partial pressure of water for a given HCl pressure (pickup curves). The masses we were focused on belong to different hydronium-water-clusters.

MO 8.4 Mon 16:00 P1

Femtosecond vibrational wavepacket spectroscopy of mixed rubidium and potassium trimers formed on helium nanodroplets — Christian Giese[1], Frank Stienkemeier[1], •Marcel Mudrich[1], Andreas Hauser[2], and Wolfgang Ernst[2] — [1]Physikalisches Institut, Universität Freiburg, Germany — [2]Institut für Experimentalphysik, Technische Universität Graz, Austria

Femtosecond wave packet spectroscopy of alkali molecules attached to helium nanodroplets provide high resolution vibrational spectra of weakly bound high-spin states [1]. We present pump-probe measurements of all combinations of homo- and heteronuclear rubidium-potassium trimers in the quartet manifold. The measured Fourier spectra are assigned to vibrational modes by comparison with high level ab-initio calculations that include spin-orbit and Jahn-Teller interactions [2]. In K_3 and Rb_3 wave packet dynamics in the states $1^4A_2'$ and $2^4E_2'$ is observed, in KRb_2 and K_2Rb dynamics in the states 1^4B_2, 3^4A_1 and 4^4B_2 is probed.

[1] M. Mudrich, Ph. Heister, Th. Hippler, Ch. Giese, O. Dulieu, and F. Stienkemeier, Phys. Rev. A 80, 042512 (2009)

[2] A. W. Hauser, G. Auböck, C. Callegari, and W. E. Ernst, J. Chem. Phys. 132, 164310 (2010)