

MO 26: Spektroskopie in He-Tröpfchen

Zeit: Donnerstag 16:30–19:00

Raum: Poster C1

MO 26.1 Do 16:30 Poster C1

Microsolvation of alkali metals in H₂O, NH₃ studied by photoionisation in helium nanodroplets — ●SEVERIN MÜLLER¹, MARCEL MUDRICH¹, FRANK STIENKEMEIER¹, and UDO BUCK² —
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Helium nanodroplets have proven to be a valuable tool for the study of tailor-made species assembled within the droplets. We apply helium nanodroplet isolation spectroscopy to study the microsolvation of alkali metal clusters in the polar solvents water and ammonia. The droplets are doped consecutively with solvent molecules and alkali atoms. Further downstream they are nonresonantly ionized by a Ti:Sa femtosecond oscillator or electron bombardment. The mass distribution of products is analyzed using a high-resolution quadrupole mass spectrometer. From the mass spectra numerous compounds of the alkali atom and different water-related particles like O, OH, H₂O are identified and their relative intensities discussed. By comparing PI spectra of different products ion chemical reactions induced by the ionization can be separated from reactions occurring already in the cold (0.4K) superfluid helium matrix. Comparison with similar studies carried out in molecular beams [1] allows us to characterize the influence of the matrix on the solvation and ionization process.

[1] C. Steinbach, U. Buck: Reaction and solvation of sodium in hydrogen bonded solvent clusters. *Phys. Chem. Chem. Phys.* 2005, 7, 986

MO 26.2 Do 16:30 Poster C1

Localisation of Calcium in ³He, ⁴He and mixed ³He/ ⁴He Nanodroplets — ●MATTHIEU DVORAK, OLIVER BÜNERMANN, and FRANK STIENKEMEIER — Physikalisches Institut, Universität Freiburg, Hermann-Herder-Str. 3, 79104 Freiburg-im-Breisgau

Electronic spectroscopy of atomic impurities in helium nanodroplets is a sensitive method for determining the localisation of the impurity in the droplet. The important observables are the shift as well as the width of electronic transitions. Atomic impurities located inside the droplet show large blue shifts identical to measurements made in bulk helium. Atomic impurities located on the surface, for example alkali metal atoms, only show small blue shifts.

We present new results of the $4s^2\ ^1S_0 \leftarrow 4s4p\ ^1P_0$ transition of calcium atoms bound to droplets formed of both helium isotopes. The results are directly compared to those obtained in bulk helium. For ⁴He the shift is much smaller in the droplet than in bulk but for helium ³He shifts are the same in both cases. The interpretation that calcium is located in the centre of the ³He droplet and on the surface of ⁴He droplets agrees with the prediction of theoretical calculations and is consistent with results obtained for strontium[1].

Calcium in ³He-⁴He mixed droplets have also been studied. The aim of this experiment is to map out a situation where calcium is located at the interface of ⁴He and ³He.

[1] A. Hernando, R. Mayo, M. Pi, M. Barranco, F. Ancilotto, O. Bünermann and F. Stienkemeier, *J. Phys. Chem. A*, **2007**, 111, 7303-7308

MO 26.3 Do 16:30 Poster C1

Solvation of HCl - aggregation of H₂O, HCl and their deuter-

ated isotopes in superfluid He droplets — MARKUS ORTLIEB, ÖZGÜR BIRER, GERHARD SCHWAAB, ●ANNA GUTBERLET, and MARTINA HAVENITH — Department of Physical Chemistry II, Ruhr-University Bochum, Universitätsstr. 150, D-44780

We investigate aggregates of HCl, H₂O and their deuterated isotopes embedded in superfluid helium using a helium nanodroplet spectrometer combined with an infrared OPO set up with an output power of up to 2.7 W and a resolution of better than 0.001 cm⁻¹. Depletion spectra of the super cooled aggregates (0.37 K) were recorded between 2650 cm⁻¹ and 2720 cm⁻¹. We were able to assign the HCl stretch vibration of the HCl-H₂O complex. We also observed spectral features of (HCl)_m(H₂O)_n aggregates and isotopes in the region of the H₃O⁺ stretch vibration. We have investigated the question of how many H₂O molecules are needed to solvate HCl. Therefore we detected the pressure dependent intensity of the signal and did mass selective spectroscopy.

MO 26.4 Do 16:30 Poster C1

IR-spectroscopy of sulfuric acid in liquid He nanodroplets

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We investigate deuterated sulfuric acid and aggregates with water at ultracold temperatures in helium-nanodroplets in the range from 2650-2680 cm⁻¹. Helium nanodroplets are formed by expansion of helium at 40 bar through a 5 μm nozzle which is kept at a temperature of 16 K. Under these conditions clusters with an average size of 5400 atoms are formed. Measurements were carried out using a high power IR-OPO (cw: 2.7 W) as radiation source. We were able to record rotationally resolved spectra which yield important information on the inherent structure.

MO 26.5 Do 16:30 Poster C1

Löslichkeit von Magnesium in Heliumtropfen — ●SEBASTIAN

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Bei einer Düsenstrahlexpansion von Helium ins Vakuum entstehen ultrakalte Heliumtröpfchen, die beim Passieren einer Pickup-Zelle Atome aus einem Dampf niedriger Dichte aufnehmen können. Ob sich die Atome nach dem Pickup auf der Tropfenoberfläche oder im Tropfen befinden, hängt von Ihrer Wechselwirkung mit dem Helium ab.

Für das Verhalten der Elemente der Erdalkalimetalle ist eine genaue Vorhersage im Rahmen des Modells von Ancilotto [1] nicht möglich. Experimente haben gezeigt, dass Ca, Sr und Ba einen stabilen Zustand an der Oberfläche der Heliumtropfen haben. Für Magnesium hingegen gibt es kontroverse experimentelle Ergebnisse [2,3]. In diesem Beitrag werden Resultate zwei unterschiedlicher experimenteller Zugänge vorgestellt. Optische Anregungsspektren von Mg-Atomen werden der energieabhängigen Ionenausbeute der Elektronenstoßionisation gegenübergestellt und die unterschiedlichen Ionisationsmechanismen diskutiert.

[1] F. Ancilotto *et al.*, *J. Low Temp. Phys.* **101**, 1123 (1995)

[2] J. Reho *et al.*, *J. Chem. Phys.* **112**, 8409 (2000)

[3] Y. Ren and V.V. Kresin, *Phys. Rev. A* **76**, 043204 (2007)