MO 19: Spektroskopie in He-Tröpfchen

Zeit: Donnerstag 14:00–15:00 Raum: VMP 6 HS-F

Hauptvortrag MO 19.1 Do 14:00 VMP 6 HS-F

Femtosecond spectroscopy of alkali-doped helium nanodroplets — •Marcel Mudrich[1], Philipp Heister[1], Martin Schlesinger[2], Walter Strunz[2], and Frank Stienkemeier[1] — [1]Physikalisches Institut, Universität Freiburg — [2]Theoretische Quantenoptik, Technische Universität Dresden

Helium nanodroplets doped with alkali atoms and molecules are intriguing systems at the border between gas-phase and condensed matter systems. Upon femtosecond laser excitation, alkali molecules exhibit vibrational wave packet oscillations which are only weakly affected by the helium environment. Subsequent desorption of the molecules off the helium droplets then leads to undamped wave packet motions. This allows for high-resolution Fourier spectra of vibrational levels in the electronic ground and excited states, as demonstrated e. g. for Rb_2 and Rb_3. The absence of vibrational damping in the triplet ground state of K_2 in contrast to damped wave packet motion in electronically excited states is discussed in the context of Landau′s critical velocity and frictionless motion in superfluid helium on the nano scale.

MO 19.2 Do 14:30 VMP 6 HS-F

Cold cluster reactions inside helium nanodroplets — •Severin Müller[1], Sebastian Krapf[2], Thorsten Koslowski[2], Marcel Mudrich[1], and Frank Stienkemeier[1] — [1]Physikalisches Institut, Universität Freiburg, 79104 Freiburg, Germany — [2]Institut für Physikalische Chemie, Universität Freiburg, 79104 Freiburg, Germany

Helium nanodroplets offer the possibility to investigate complexes of atomic and molecular constituents at a temperature of 380 mK. This low-energy environment is especially interesting for the study of reactive species, since even low energy barriers will greatly affect the dynamics of chemical reactions. We have studied the reaction of alkali clusters Ak_N (Ak=Na, K, Rb, Cs) with water clusters H_2O_M embedded in helium nanodroplets by mass spectrometry. After picking up water molecules and alkali atoms, respectively, the droplets were ionized by the output of a Ti:Sa fs laser or by the impact of electrons crossing the droplet beam.

Our results clearly show large differences in the reactivity for the different alkali species. While sodium clusters Na_N form large van der Waals-bound complexes with water, cesium clusters Cs_N undergo chemical reactions to form hydroxide clusters. Upon ionization, these clusters fragment along competing decay channels. The experimental data are backed up by high-level quantum chemical calculations. The abundance patterns found in the mass spectra are explained by the stabilities of different cluster ions with regard to fragmentation and are largely independent of the applied ionization scheme.

MO 19.3 Do 14:45 VMP 6 HS-F

Electronic Spectroscopy of Pyrromethene Dyes in Superfluid Helium Droplets — •Dominik Pentlehner, Anja Stromeck-Faderl, Bernhard Dick, and Alkwin Slenczka — Universität Regensburg, Institut für Physikalische und Theoretische Chemie, 93053 Regensburg, Germany

Among the vibrational modes of pyrromethene (PM) dyes the low-frequency modes are a significant spectroscopic signature. Electronic spectra of gas phase samples show low frequency progressions which depend on the substituents such as methyl or phenyl. These low-frequency modes are sensitive to interactions with the environment and thus are suited to study the helium-dopant interaction in superfluid helium droplets. Our project aims for a better understanding of this interaction which allows for both, a highly efficient dopant to helium energy dissipation, but also for free dopant rotation. Therefore, we have measured fluorescence excitation spectra and dispersed emission spectra of various PM dyes in the gas phase as well as in helium droplets, which are generated by a pulsed Even-Lavie valve.

In contrast to most electronic spectra of molecules embedded into helium droplets, the spectra of some of the PM dyes in helium droplets deviate from the respective gas phase data by substantial broadening or even missing of vibronic transitions. Our data reveal a correlation between the presence of low energy modes in the gas phase and the line broadening effect in helium droplets.