Solvation dynamics of metallic dopants in helium droplets

The unique experimental conditions provided by helium nanodroplets (HeN) are not only utilized in a special form of matrix isolation spectroscopy [1] but are also interesting for the study of molecular collisions in a superfluid solvent. Superfluid droplets of 104 to 107 helium atoms (HeN) are doped with one or several atoms or molecules that move freely in or on the droplets and may form complexes in this cold environment. For a while, it was believed that all species that are collected inside a droplet, will immediately coagulate and form a stable aggregate in the cold environment. Unfortunately, things are not so simple. Even two atoms of the same species residing on the same droplet, may be separated by a helium barrier as observed for one Cr atom in the a7S3 ground state and one in the a5S2 metastable state [2,3].

Cold metal aggregates of different size can be generated in helium droplets, and core-shell clusters and nanowires with one metal surrounding a core of different kind are observed and deposited on solid substrates [4]. However, the sequence of doping does not always determine the core-shell structure, and the temperature of the substrate has an influence on the final cluster or wire structure. New results from time-of-flight mass spectroscopy in the beam and high resolution electron microscopy including tomography for various metallic mixtures will be presented.

[1] C. Callegari and W. E. Ernst, in: *Handbook of High Resolution Spectroscopy*, Eds. F. Merkt and M. Quack, 1st Edition, Vol. 3, 1551-1594 (2011).

[2] A. Kautsch, M. Koch, and W. E. Ernst, *PCCP* online (2015), <http://dx.doi.org/10.1039/c5cp01009h>.

[3] M. Ratschek, J. V. Pototschnig, A. W. Hauser, W. E. Ernst, *J. Phys. Chem. A* **118** (33), 6622 (2014).

[4] P. Thaler, A. Volk, F. Lackner, J Steurer, D. Knez, W Grogger, F Hofer, and W E. Ernst, *Phys. Rev.* *B* **90**, 155442 (2014).