CFEL SCIENCE

SEMINAR

14th June 2018 - 10:00 h

CFEL – Building 99, seminar room I+II (ground floor)

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X-ray spectroscopy and imaging of free metal clusters

Clusters in principle allow to follow the development of material properties from the atom to the bulk, but often exhibit characteristics far from those of these limiting cases, which makes them especially interesting. Recent technological developments make it possible to study free clusters with well defined size and temperatures down to a few Kelvin. Furthermore, the range of spectroscopic tools has been extended; for example the development of highly intense x-ray sources and advanced trapping techniques now allows to perform x-ray absorption spectroscopy on size-selected clusters.

Core shell x-ray absorption spectroscopy (XAS) is an element specific technique which can be used to study the local electronic structure of the atoms adressed [1]. The measurement of x-ray magnetic circular dichroism, which can be achieved by performing XAS-experiments with circularly polarized light on cold free size-selected clusters stored in an ion trap within a strong magnetic field, can be employed to measure the spin and orbital moment of 3d-transition metals clusters [2,3,4] or even that of single magnetic doping atoms in nonmagnetic clusters [5].

X-rays can also be used to perform time-resolved diffraction experiments on clusters in the gas phase, which allows to directly follow cluster dynamics like melting after optical excitation. For such experiments a tunable aerodynamic lens for cluster beam focusing has been developed, which will be briefly discussed.

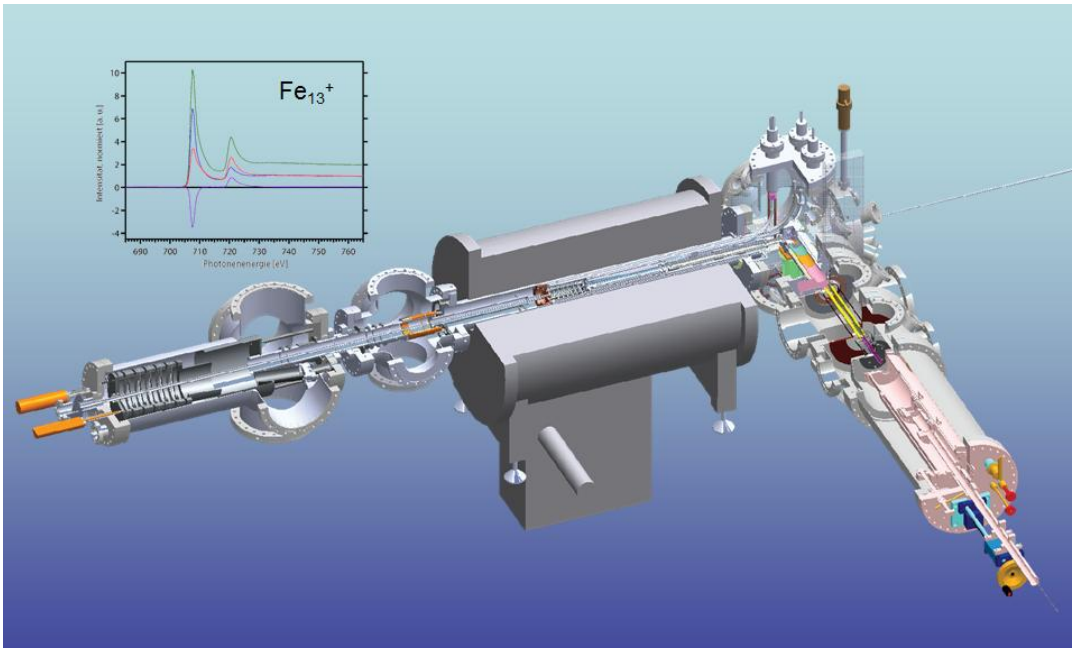
[1] J. T. Lau, J. Rittmann, V. Zamudio-Bayer, M. Vogel, K. Hirsch, Ph. Klar, F. Lofink, T. Möller, and B.v.Issendorff, Phys. Rev. Lett. 101, 153401 (2008)

[2] M. Niemeyer, K. Hirsch, V. Zamudio-Bayer, A. Langenberg, M. Vogel, M. Kossick, C. Ebrecht, K. Egashira, A. Terasaki, T. Möller, B. v. Issendorff and J. T. Lau, Phys. Rev. Lett. 108, 057201 (2012)

[3] V. Zamudio-Bayer,K. Hirsch, A. Langenberg, M. Niemeyer, M. Vogel, A. Lawicki, A. Terasaki, J. Tobias Lau, and B. v. Issendorf, Angewandte Chemie Int. Ed. 54, 4498 (2015)

[4] V. Zamudio-Bayer, R. Lindblad, C. Bülow, G. Leistner, A. Terasaki, B. v. Issendorff, and J. T., J. Chem. Phys. 145, 194302 (2016)

[5] K. Hirsch, _ V. Zamudio-Bayer, A. Langenberg, M. Niemeyer, B. Langbehn, T. Möller, A. Terasaki, B. v. Issendorff, and J. T. Lau, Phys. Rev. Lett. 114, 087202 (2015)



Host: Terry Mullins / CFEL Molecular Physics Seminar