PHYSIKALISCHES KOLLOQUIUM

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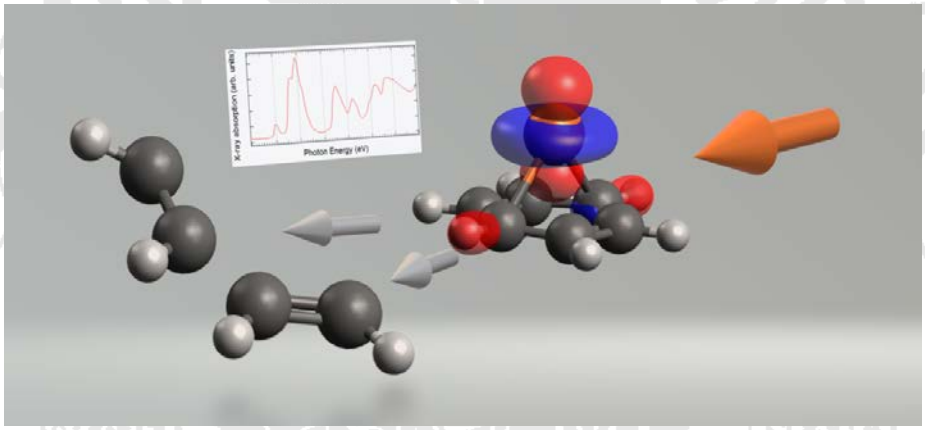

X-RAYS AND COLD ION: A PERFECT MATCH TO STUDY SPIN AND CHARGE IN GAS-PHASE MODEL SYSTEMS – FROM METAL IONS TO MOLECULAR MAGNETS

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Transition metals show a rich variety of magnetic order, are known exist in numerous oxidation states, and play a crucial role as active centers in metalloenzymes. We are investigating the electronic and magnetic properties of these transition metal centers at the smallest scale, from single atoms to diatomic molecules to small clusters, chelates, and organometallic coordination entities, which we prepare atom by atom or ligand by ligand. Our goal is to arrive at a fundamental understanding of energy levels, spin states, oxidation states, and valence electron delocalization in coordination entities of 3d and 4f transition elements that allows for tailoring of electronic and magnetic properties. To this end, we make use of the local and element-specific nature of core-level excitation to investigate the electronic structure in ultra-dilute gaseous, solvated, and liquid samples. This is achieved with a unique cryogenic ion trap setup for gas-phase soft x-ray absorption (XAS) and x-ray magnetic circular dichroism (XMCD) spectroscopy as well as a liquid-jet setup for resonant inelastic x-ray scattering (RIXS) at BESSY II, both of which are designed to study highly-dilute gas-phase and liquid-phase matter. With these techniques, we are able to follow the stepwise coordination of metal centers ligand by ligand, from coordinatively unsaturated to coordinatively saturated complexes, and to directly probe the effect of coordination and solvation on the metal center by following he associated changes in its spin state or oxidation state.