Liquid-jet photoelectron spectroscopy of aqueous solutions: Electron scattering, electronic structure and work functions

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The electronic structure of liquid water and aqueous solutions is directly accessible by liquid-jet photoelectron spectroscopy (LJ-PES). Energies of photoelectron spectral features have so far typically been referenced to the vacuum-energy level, *i.e.*, in relation to the gas phase, which per definition disregards explicit surface properties such as the work function of aqueous solutions. We discuss how the solution work function changes, as a function of solute type and concentration, can be inferred from a LJ-PES measurement, based on an explicit consideration of a solution's Fermi energy. Competing surface-charging effects contributing to energy shifts of solute and solvent spectral features are important to be quantified and will be explored. This inherently connects to the ability to extract accurate electron binding energies from aqueous solution via LJ-PES experiments.

This talk further discusses the application of LJ-PES to provide structural information of biomolecules in a complex aqueous environment, such as adenosine triphosphate interacting with metal cations. This is achieved by the simultaneous analysis of valence, core-level, and non-local autoionization electron signals. We conclude with a consideration on applying electron Velocity Map Imaging (VMI) to liquid jets, with a focus on electron scattering in solution. VMI promises to vastly increase photoelectron collection efficiency and angular range, and in particular to enable the detection of photoelectron angular distributions in a single measurement. This includes the challenging detection of photoelectron circular dichroism (PECD) from aqueous-phase chiral (bio)molecules.