XUV-induced Electron Solvation Dynamics in Water Clusters and New Perspectives in Higher Harmonic Pulse Manipulation

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The solvation of electrons in aqueous solutions plays a nearly ubiquitous role in biological and chemical systems. However, a fundamental understanding of the solvation properties (e.g. solvation time, binding energies, solvation shells, and binding motifs) has yet to be attained. Here, we report the first observed XUV-induced electron solvation in water clusters where subsequent to ionization the electron is recaptured in the cluster. The binding energy of the electron is measured by means of velocity map imaging in a pump-probe scheme where we find different solvation states occurring at different times in the femtosecond to picosecond range. The slower dynamics of deuterated water clusters has also been investigated as comparison. XUV femtosecond pulses were provided by the seeded free electron laser FERMI. Results are discussed in connection with experiments on water cluster anions, liquid jets and corresponding theory.

Furthermore, pulse manipulation schemes are discussed where phase modulation of IR or UV seed pulses can be employed for XUV coherent control or 2D spectroscopy experiments. The crucial isolation of higher order signal components is demonstrated in a wave packet interferometry experiment.