Angle-resolved Photoelectron Spectroscopy of large Water Clusters ionized by an XUV Comb

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Detailed knowledge about photo-induced electron dynamics in water is key to the understanding of several biological and chemical mechanisms, in particular for those resulting from ionizing radiation [1]. While several studies reporting on detailed low-energy electron scattering cross sections in amorphous ice, liquid water and large water clusters [2] and a time-resolved approach to investigate electron scattering in water has been reported [3], such investigations in gas-phase water clusters have shown to be a promising bridge between the gas and liquid phase, allowing for many technological limitations to be overcome and setting a clear route to perform attosecond-resolved spectroscopy of hydrated molecules. Indeed, extreme ultraviolet (XUV) attosecond pulses may be used to photo-ionize a water sample and to investigate the electron dynamics and transport properties with extremely high temporal resolution [4].

We report a method to obtain photoelectron spectra from neutral water clusters following ionization by an extreme-ultraviolet (XUV) harmonic comb. Typically, a large background signal in the experiment arises from water monomers and carrier gas used in the cluster source (Fig. 1). We report a protocol to quantify this background in order to eliminate it from the experimental spectra. We disentangle the accumulated XUV photoionization into contributions from the species under study and the photoelectron spectra from the clusters. This study demonstrates feasibility of background free photoelectron spectra of large water clusters illuminated with XUV combs and paves the way for the detailed time-resolved analysis of the underlying dynamics.

Example References
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