**Capturing Transient Species in Ionized Liquid Water and Aqueous Solutions**

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**Abstract**

The ionization of liquid water serves as the principal trigger for a myriad of phenomena that are relevant to radiation chemistry and radiation biology. The earliest events that follow the ionization of water, however, remain relatively unknown. In this talk, I will present some recent results from my group that shed light on the ultrafast dynamics of ionized liquid water and biomolecules in aqueous solution. By employing few-cycle pulses in the visible to near-infrared (500 – 900 nm) and the short-wave infrared (0.9 – 1.7 **m), we have performed a comprehensive probe of the fate of the electron that is initially injected into the conduction band by strong-field ionization. In complementary experiments, we have employed femtosecond soft X-ray free-electron laser probing at the oxygen K edge to track the primary proton transfer reaction of strong-field ionized liquid water. These studies of the ultrafast dynamics of strong-field ionized liquid water have recently been extended to the strong-field ionization of redox-active amino acids – tyrosine, tryptophan, and phenylalanine – in aqueous solution. There, we observe coherent vibrational wave packet dynamics involving multiple vibrational modes. The wave packet dynamics encode the ultrafast structural rearrangement that is triggered by electron ejection. These studies shed light on the elementary ultrafast dynamics that accompany the interaction of ionizing radiation with molecules of biological importance.