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Ultrafast Electronic Relaxation Dynamics of Ionized Liquid Water[1] ZHI-HENG LOH, PEI JIANG LOW, ZHAOGANG NIE, Nanyang Technological University — 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 liquid water, however, remain relatively unknown. We have embarked on a series of studies to investigate the ultrafast dynamics of intense laser-ionized liquid water. Optical pump-probe spectroscopy employing few-cycle pulses in the visible (500–700 nm) and short-wave infrared (0.9–1.7 μm) is used to reveal the fate of the electron that is initially injected into the conduction band by ionization. These experiments yield the lifetime of the conduction-band electron and the timescale for vibrational cooling of the s electron. Remarkably, our results suggest that the relaxation of the conduction band electron to the hydrated s electron proceeds via an intermediate state — possibly the elusive p state electron — whose lifetime is found to be 63 ± 3 fs (94 ± 8 fs) in H_2O (D_2O). These results provide a comprehensive view of the electronic relaxation dynamics of ionized liquid water.

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