Ultrafast Dynamics of Liquid Water Irradiated by Picosecond Proton Pulses
N. Breslin, M. Coughlan, H. Donnelly, G. Nersisyan, B. Dromey

Queen’s University, Belfast, Northern Ireland

Across many areas of radiation chemistry, the characteristics and behaviour of the solvated electron has been extensively studied since its discovery in 1962. When ionising radiation reacts with water molecules, these solvated electrons are produced and have the potential to cause unrepairable damage to DNA, making them a desirable by-product for applications in radiation biology.

Recently experiments have been performed using the TARANIS laser facility at Queen’s University Belfast (800 fs, 1053 nm, 20 J). We have examined the dynamics of solvated electrons through the interaction of laser-driven protons with water in the form of an ion-induced opacity. By using a pump-probe technique with a high degree of synchronicity, the evolution of the opacity is observed on a sub nanosecond scale (10⁻⁹ s), probing the reaction during and immediately after the proton interaction with the water. This evolution is monitored by examining the onset and recovery of the opacity upon reaction, and any underlying processes which could potentially be effecting the waters recovery are discussed.