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Ultrafast pulsed proton radiolysis in water: Delayed solvation time of electron

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Bursts of laser driven protons have recently been shown to provide the basis for the study of ultrafast ion-matter interactions in both solid [1] and liquid [2] states. This is allowing the first real time study of the evolution of a key species in of water chemistry - the solvated electron. Formed when polar water molecules re-orientate to shield the charge of free ionised electrons, the solvation process leads to the formation of this long lived highly reactive species that can seed the formation of potent radicals. Here we show that the interaction of protons in water leads to a delay in the growth of the photoabsorption band of the solvated electron in comparison to that generated by fast electrons/X-rays. For our conditions we show that this time extends to 100's of picoseconds (ps, 10^-12s) under proton irradiation. Our initial interpretation is that proton stopping in water leads nanocavitation in the Bragg region which in turns leads to increased thermal motion of the surround water molecules, thus inhibiting the solvation process.
[1]Dromey et al., Nat.Comms.,4, 1763 (2013)
[2]Senje et al., App. Phys. Letts., 110, 104102 (2017);

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