Fragmentation of gas-phase nucleobases following direct ionisation and electron capture by incident protons

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The first branching ratios are presented for ionisation and dissociative ionisation by proton impact upon uracil in the energy range 20-150 KeV and upon adenine, cytosine, and thymine at 80 KeV. Specific ions and fragment ions were identified by time-of-flight (TOF) mass spectrometry. In addition to comparing the effects of proton irradiation on different biomolecules to provide clues to their roles in radio-sensitivity, a key objective of this work was to draw direct comparisons between different ionisation processes. Through event-by-event determination of the projectile charge state post-collision, it was possible to identify the process which produced each detected ion: *electron capture* (with projectile neutralisation) or *direct ionisation* (with the emission of an electron into the continuum). This distinction is of particular importance for the molecular-scale understanding of radiation damage in biological material as the Bragg Peak (the phenomenological basis for cancer therapy techniques utilizing ion beams) is understood to result from the interplay between ionisation, excitation, and charge exchange processes as incident ions slow down in an absorbing medium [1]. To the authors' knowledge, the present results provide the first comparison of molecular fragmentation by electron capture and by direct ionization in proton collisions with relatively large and electronically complex molecules; previous data is only available for O_2 [Luna *et al.* 2005] and H_2O [Gobet *et al.* 2004, Luna *et al.* 2007].

References:
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