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Positron interactions with biosystems[1]

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Positrons have increasing importance in medicine, through the use of Positron Emission Tomography (PET), where a radioisotope is injected into the body, typically attached to a glucose molecule. These molecules accumulate in regions of high metabolic activity, and once there a positron is emitted. After thermalising, these positrons annihilate, emitting back-to-back gamma rays, which can be used to locate and image tumors, for instance.

At the Australian National University, we use a low energy positron beamline [1] to investigate the interactions of positrons with molecules that can be used to start building a model of the environment in which these positrons thermalise [2]. In particular, positrons can induce damage, as well as generating a host of secondary electrons which can cause damage of their own. To better understand these processes, high accuracy measurements are required to verify theoretical calculations and models of these processes.

This talk will present recent results on the interaction of positrons with furan, one of a class of molecules that in used to model elements of the DNA structure. The measurements in include elastic and inelastic scattering, as well as positronium formation, and are compared to recent theories from colleagues using the Independent Atom Model and the Schwinger Multichannel approach.

In addition, the outline of a new experimental effort will be presented, which aims to make measurements of positron thermalisation in liquid water [3]. This will be an important step in verifying many of the assumptions made in using gas phase cross sections to model positron interactions in liquids, and should lead to new tests of recent model approaches that aim to build a complete picture of the positron thermalisation process.

[1] J. P. Sullivan et al., Rev. Sci. Instr. 79, (2008) 113105
[2] Tattersall et al., J. Chem. Phys. 140, 044320 (2014)
[3] F. Blanco et al., J. Phys. B 49, 145001 (2016)

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