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Positron scattering measurements for application to medical physics

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While the use of positrons in medical imaging is now well established, there is still much to learn regarding the transport of positrons through the body, and the subsequent damage induced. Current models of dosimetry use only a crude approximation of the collision physics involved, and at low energies misrepresent the thermalisation process to a considerable degree. Recently, collaborative work has commenced to attempt to refine these models, incorporating a better representation of the underlying physics and trying to gain a better understanding of the damage done after the emission of a positron from a medical radioisotope. This problem is being attacked from several different angles, with new models being developed based upon established techniques in plasma and swarm physics. For all these models, a realistic representation of the collision processes of positrons with relevant molecular species is required. At the Australian National University, we have undertaken a program of measurements of positron scattering from a range of molecules that are important in biological systems, with a focus on analogs to DNA. This talk will present measurements of positron scattering from a range of these molecules, as well as describing the experimental techniques employed to make such measurements. Targets have been measured that are both liquid and solid at room temperature, and new approaches have been developed to get absolute cross section data. The application of the data to various models of positron thermalisation will also be described.