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Abstract for an Invited Paper
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On the modelling of positron transport in gases and soft-condensed biomaterials[1]

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The understanding and optimization of positron technologies such as Positron Emission Tomography requires a fundamental understanding of the underpinning physical processes involved, including accurate knowledge of the input positron scattering cross sections, material structure, and transport theories/simulations. The availability of new accurate and more complete sets of positron interaction cross sections has facilitated new theoretical investigations of positron transport. In this presentation we will highlight recent attempts to validate the accuracy and completeness of cross-sections through comparison with available swarm data. Comparisons between electron and positron transport will be presented and the importance of the positronium formation process on transport highlighted. As we progress towards a model of transport in soft-condensed systems (e.g. human tissue), we will discuss the theoretical formalism and present preliminary results for the transport and relaxation of positrons in dense gaseous and soft-condensed systems in spherical geometry. In particular a multi-term Boltzmann equation solution and associated eigenfunction treatment will be compared to a Monte-Carlo simulation. In these systems, the structure of the medium and effects of coherent scattering plays a significant role and we will highlight how this theory will need to be modified to consider biological polar liquids such as liquid water.

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