Keep-in-Touch VIP meeting
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Kinetic and fluid modeling of non-equilibrium electron and ion transport in gaseous and liquid matter

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Accurate modelling of electron and ion transport in plasmas, plasma-liquid and plasma-tissue interactions is dependent on (amongst other things) (i) the existence of accurate and complete sets of cross-sections, (ii) an accurate treatment of electron/ion transport in these phases, (iii) accurate description of other processes present e.g. localization (trapping), bubbles, etc. and (iv) understanding of the electron transport across the gas-liquid interface.

The accuracy and completeness of electron-biomolecule cross-section sets can be assessed by comparison of calculated transport coefficients with those measured using a pulsed-Townsend swarm experiment of de Urquijo and co-workers. In this presentation we will present results from our recent studies of electrons in water, as the natural surrogate for human tissue. In addition, while DNA is currently not convenient to study, tetrahydrofuran (THF – C4H8O) has been investigated as a close analogue for low-energy electron interactions with 2-deoxyribose, a sugar that links phosphate groups in the DNA backbone.

Our program for modelling of electron/ion transport in gases, liquids and soft-condensed matter is considered through appropriate generalisations of Boltzmann's equation to account for spatial-temporal correlations present in liquids [1,2], including self-trapping of electrons into bubble states [3], and combined localised-delocalised nature of transport [4]. Unified solutions of Boltzmann's equation for electrons and ions for various media are made within a space and time-dependant multi-term framework. In the presentation we will highlight our results for the transport of electrons in various liquids including preliminary ab-initio results for electron capture into liquid fluctuations generating well known bubble states for atomic liquids [3].

A consequent high order fluid model has been developed to consider non-local electron transport in gases, liquids and gas-liquid interfaces. In particular, the explicit density effects across the gas-liquid interface have been considered including its impact on collisional processes and background energy/fields [5,6]. Applications to be presented include the propagation of ionization fronts between the gas and liquid phases.

REFERENCES

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