Challenges in Obtaining Cross Sections from Electron Swarm Data

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Inferring scattering cross sections from electron swarm experiments through the repeated solution of Boltzmann's equation began in the 1960s with the work of Phelps and collaborators [1]. Since then, different approaches have been explored to automate this process, including the use of optimisation algorithms and artificial neural networks [2,3].

Essential to automating the solution of this "inverse swarm problem" is the ability to solve Boltzmann's equation quickly and robustly. With this in mind, we consider the two-term approximation and solve Boltzmann's equation by integrating inward from high energies; a technique known as backward prolongation [4].

We present a technique for determining bulk transport coefficients efficiently by applying the principle of linear superposition. To demonstrate, we find and compare bulk transport coefficients for electrons and positrons in magnesium and beryllium metal vapours [5,6].

Finally, nonlinear least-squares fitting of argon's elastic cross section is attempted and the ill-posed nature of the inverse problem is highlighted.

References

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