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Proposed recommendations for analytic anisotropic elastic scattering models for electron-neutral collisions in edge plasma modelling

Content

Modelling tokamak edge plasmas require accurate techniques to understand the interplay between microscopic and macroscopic processes. A prime example of this interplay is how particle and Monte Carlo simulation codes use angular scattering information of electrons following scattering events within a simulation. It is well known that the forward peaked nature of high energy electron elastic scattering is relatively trivial to accurately describe in plasma simulations. However, for lower energy collisions, which can produce near isotropic or even backward peaked differential cross sections, there is not a strong consensus among the plasma modelling community on how to best describe these angular scattering trends. Resolution of this anisotropic scattering behaviour is important to ensure simulated macroscopic properties, such as particle and heat fluxes delivered to device walls, are based on physically reasonable data assumptions. In this study we propose a systematic method to approximate the aforementioned non-trivial angular scattering behaviour with a formula that can be readily implemented in Particle-in-Cell and/or Monte Carlo plasma simulation codes. Specific application of this method is demonstrated for targets relevant to the edge modelling problem of tokamaks such as ITER, with recommendations provided for atomic hydrogen and helium, as well as for molecular hydrogen.

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