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Simulating Electron Scattering in Cold-Cathode Discharges¹ ALEXANDER V. KHRABROV, IGOR D. KAGANOVICH, Princeton Plasma Physics Laboratory — Accurate representation of anisotropic scattering in collisions is required for particle simulations of plasmas with energetic $(10^2 - 10^3 \text{ eV})$ electrons, especially in weakly collisional regimes. A high-voltage glow discharge in helium is a good example. Electron multiplication in the cathode layer occurs with only a few ionizing collisions per each primary electron. Thus the flux of energetic electrons, which provide ionization in the negative glow, depends on the structure of the strongly anisotropic electron velocity distribution in the cathode fall. To simulate the discharge kinetics, defined by non-local transport and non-Maxwellian distributions, one needs to correctly represent the angular scattering of electrons on atoms within a large energy range. In simulations, the scattering should adequately reproduce the macroscopic transport properties and also allow rapid sampling of the probability distribution. An important condition for the model differential cross-section is that it should yield the correct value of the transport (momentum-transfer) cross section as a function of electron energy. We present a practical approximation of energydependent scattering in helium for energies between 0.01 and 1000 eV, with correct asymptotic behavior at higher energies.

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