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Kinetic Theory of Collisional Sheath H.L. RAPPAPORT, Enig Associates — Electron dynamics in the collisional sheath of a weakly ionized gas are investigated in the regime in which the electron mean free path is very small compared with the Debye length. The electron distribution function and the Boltzmann collision operator for electron neutral collisions are expanded in spherical harmonics to produce a modified relaxation time approximation. We believe this approximation to be valid even when the distribution function is very far from Maxwellian, as is the case near a particle absorbing boundary. The Boltzmann equation is then formulated for monoenergetic groups of particles and integrated along the characteristics of the collisionless equation to reduce the problem to a solving a single Fredholm integral equation. Results illustrate and quantify the remarkable role played by electron inertia at distances on the order of one mean free path from the boundary in the otherwise collision dominated system. Comparisons with approximate hydrodynamic boundary conditions made in recent literature are given and implications for dust grain charging discussed.

H.L. Rappaport
Enig Associates

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