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Enhancement of the Coulomb collision rate by individual particle wakes SCOTT BAALRUD, BRETT SCHEINER, Department of Physics and Astronomy, University of Iowa — Charged particles moving in a plasma leave a trailing wake in their electric potential profile associated with the response function of the medium. For superthermal particles, these wakes can cause significant departures from the oft-assumed screened Coulomb potential profile. The wakes extend the interaction length scale beyond the Debye screening length for collisions between fast test particles and field particles in their wake. This can increase the Coulomb collision rate for velocities beyond the thermal speed. To demonstrate this effect, we consider the relaxation rate due to electron-electron collisions of an electron distribution function with initially depleted tails, as is common near boundary sheaths or double layers. This problem is related to Langmuir's paradox. We compare the standard Landau (Fokker-Planck) collision operator, which does not account for wakes, with the Lenard-Balescu collision operator, which includes wake effects through the linear dielectric response function. For this distribution, the linear dielectric is described by the incomplete plasma dispersion function.[1] We compare the collision operators directly as well as the relaxation rate determined from a hybrid kinetic-fluid model.

[1]S. D. Baalrud, Phys. Plasmas 20, 012118 (2013).

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