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Improvement to the Effective Potential Transport Theory Based on Enkog's Theory of Dense Gases[1] SCOTT D. BAALRUD, University of Iowa, JEROME DALIGAULT, Los Alamos National Laboratory — We recently proposed a method for extending traditional plasma transport theories to strong coupling using a binary collision model in which many-body correlation effects were included through an effective interaction potential [1]. By comparing with molecular dynamics simulations, this was shown to be quite successful at extending the binary collision approach well into the strongly coupled regime. However, one persistent feature was an approximately 30% overestimation of the collision rate in the range $1 < \Gamma < 50$, were Γ is the coupling parameter. Here we show that this can be corrected by applying the same scattering cross section to Enskog's kinetic equation for dense gases, rather than Boltzmann's equation for dilute gases. The salient new physics is an exclusion radius for the probability distribution of initial scattering positions that arises due to the strong Coulomb repulsion at close distances; i.e., by accounting for the finite size of particles. Although Enskog's equation was developed exclusively for hard spheres, we propose a connection between the Percus-Yevick equation for hard spheres and the hypernetted chain equation to find the appropriate exclusion radius for Coulomb systems.

[1] S.D. Baalrud, and J. Daligault, PRL 110, 235001 (2013).

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