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Electron Transport in Dense Plasmas using the Quantum Landau-Fökker-Planck Model NATHANIEL SHAFFER, CHARLES STARRETT, Los Alamos National Laboratory — We present predictions of electrical and thermal conductivity of dense plas- mas using the quantum Landau-Fökker-Planck (qLFP) model of collisions. The qLFP model improves on the familiar classical theory because it respects the Pauli Exclusion Principle. This makes it suitable to interrogate the transport properties of hot, dense plasmas, where the electrons are too hot to be treated as a Fermi liquid but too dense to be treated as a classical gas. This important regime is taxing to study with quantum molecular dynamics simulations, and recent evidence suggests that the standard Kubo-Greenwood method for computing thermal conductivity from these simulations lacks essential electron-electron collision effects [M. P. Desjarlais et al., Phys. Rev. E 95, 033203 (2017).]. The qLFP theory is nominally limited to weak-coupling conditions where small-angle scattering dominates transport. We extend its domain of validity to higher densities and lower temperatures using a Coulomb logarithm model that includes strong-coupling effects through a cross-section computed using the potential of mean force. The model recovers the standard Spitzer-Härm results in the non-degenerate limit and breaks down in the degenerate liquid-metal regime due to the small-angle approximation.

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