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Study of shear viscosity for dense plasmas by equilibrium molecular dynamics in asymmetric Yukawa ionic mixtures[1] TOMORR HAXHIMALI, ROBERT RUDD, WILLIAM CABOT, FRANK GRAZIANI, Lawrence Livermore National Laboratory — We present molecular dynamics (MD) calculations of shear viscosity for asymmetric mixed plasma for thermodynamic conditions relevant to astrophysical and Inertial Confinement Fusion plasmas. Specifically, we consider mixtures of deuterium and argon at temperatures of 100-500 eV and a number density of 10^{25} *ions/cc*. The motion of 30000-120000 ions is simulated in which the ions interact via the Yukawa (screened Coulomb) potential. The electric field of the electrons is included in this effective interaction. Shear viscosity is calculated using the Green-Kubo approach with an integral of the shear stress autocorrelation function, a quantity calculated in the equilibrium MD simulations. We study different mixtures with increasing fraction of the minority high-Z element (Ar) in the D-Ar plasma mixture. In the more weakly coupled plasmas, at 500 eV and low Ar fractions, results from MD compare very well with Chapman-Enskog kinetic results. We introduce a model that interpolates between a screened-plasma kinetic theory at weak coupling and the Murillo Yukawa viscosity model at higher coupling. This hybrid kinetics-MD viscosity model agrees well with the MD results over the conditions simulated.

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