Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Species Diffusion in Plasma Mixtures[1] ROBERT RUDD, TOMORR HAXHIMALI, WILLIAM CABOT, FRANK GRAZIANI, Lawrence Livermore Natl Lab — Diffusion of ions in a plasma is a non-equilibrium process that occurs in response to concentration gradients and other drivers. In weakly coupled plasmas the rate of diffusion is largely governed by binary collisions, and the diffusivity can be calculated reliably using Chapman-Enskog theory. As typical of this kind of calculation, the well-known result includes a Coulomb logarithm. When the plasma is more strongly coupled, the binary scattering approximation fails and the Coulomb logarithm becomes problematic. Here we report the result of molecular dynamics simulations of ion diffusion in a D-Ar plasma mixture over a range of temperatures 100 eV to 10 keV. These results extend our prior work which focused on 100 eV [Haxhimali et al., Phys. Rev. E 90, 023104 (2014)]. In the process we clarify how the strongly coupled liquid-like diffusion transitions smoothly to the weakly coupled gas-like diffusion at higher temperatures, getting good agreement with kinetic theory calculations at the higher temperatures [Paquette et al., Astrophys. J. Suppl. 61, 177 (1986)].

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

Robert Rudd
Lawrence Livermore Natl Lab

Date submitted: 12 Jul 2016 Electronic form version 1.4