

Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Effective Potential Theory for Diffusion in Binary Ionic Mixtures¹

NATHANIEL R. SHAFFER, SCOTT D. BAALRUD, University of Iowa, Department of Physics and Astronomy, JEROME DALIGAULT, Theoretical Division, Los Alamos National Laboratory — We present theoretical predictions of diffusion coefficients for classical binary ionic mixtures spanning weak to strong coupling. Strongly coupled, classical ionic mixtures are realized in non-neutral plasmas, and they serve as a useful reference system for ultracold plasmas and warm dense matter. We model many-body correlation effects on transport by treating binary interactions via the potential of mean force and by treating the Coulomb hole around each ion with an effective exclusion radius. This approach is known to agree closely with molecular dynamics results for the transport properties of single-component plasmas - including warm dense matter - up to the onset of liquid-like correlations, and we find a comparable range of agreement for the interdiffusion coefficient of binary ionic mixtures. We also present the self-diffusion coefficients of the two ion species in a mixture, in light of recent measurements in ultracold neutral plasmas². An outlook for applying the theory to electron-ion transport in the strong coupling regime is also considered.

¹The authors gratefully acknowledge support from NSF grant PHY-1453736.

²Strickler, T. S., Langin, T. K., McQuillen, P., Daligault, J., & Killian, T. C. 2016, Phys. Rev. X, 6, 021021

Nathaniel Shaffer
University of Iowa

Date submitted: 14 Jul 2016

Electronic form version 1.4