Abstract Submitted
for the DPP09 Meeting of
The American Physical Society

Strongly Coupled Plasma Dynamics Using the Particle-in-Cell Methodology[1] D.V. ROSE, T.C. GENONI, D.R. WELCH, R.E. CLARK, Voss Scientific, LLC, T.A. MEHLHORN, R.B. CAMPBELL, D.G. FLICKER, W.A. STYGAR, Sandia National Laboratories — Three-dimensional simulations of moderately to strongly coupled electron-ion and multi-component plasmas using the particle-in-cell method are presented. The simulations resolve sub-Debye- length inter-particle spacing to accurately model the dynamics of these systems. We consider realistic mass ratios and quasi- equilibrium conditions with different component temperatures which are relevant on short time scales. The simulation results are in very good agreement with classical hypernetted chain calculations for dense electron-ion and ion-ion plasmas [1]. Our results demonstrate the feasibility and utility of large-scale particle-in-cell simulations for the modeling and analysis of multi-component moderately and strongly coupled plasmas. Application of the simulation model to conductivity [2] and mass-stopping power of energetic ions in strongly coupled plasmas is discussed.

[1] V. Schwarz, et al., Contrib. Plasma Phys. 47, 324 (2007).
[2] W. A. Stygar, G. A. Gerdin, and D. L. Fehl, Phys. Rev. E 66, 046417 (2002).

[1]Work supported by Sandia National Laboratories through U.S. DOE.

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Date submitted: 21 Jul 2009 Electronic form version 1.4