Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Hybrid fluid-kinetic models for high-energy-density plasmas[1]
SEAN MILLER, ERIC CYR, THOMAS GARDINER, MATTHEW BETTENCOURT, NATHANIEL HAMLIN, KRISTIAN BECKWITH, SIDNEY SHIELDS, Sandia National Lab — Plasma physics in the high-energy-density regime can be dominated by collisional interactions between particles. Particle-in-cell (PIC) based kinetic representations have classically been used to represent these systems in rarefied regimes, however as the density of the plasma increases - or a neutral gas is introduced - the computational costs of particle methods increase. The goal of this research is to develop hybrid representations where the addition of continuum fluid components to the particle solve reduces runtimes in dense plasma simulations while retaining physical accuracy in rarefied regimes. Two approaches will be presented: (1) a species-based coupling where each species is represented by a different discretization (e.g. PIC ions with fluid electrons/neutrals), and (2) a PIC discretization is used to close the fluid model - commonly known as a delta-f method. The current state of our implementation will be presented and the benefits and challenges of these approaches will be discussed.

[1]Sandia National Labs is managed and operated by National Technology Engineering Solutions of Sandia, LLC, a subsidiary of Honeywell International, Inc., for the U.S Dept. of Energys National Nuclear Security Administration under contract DE-NA0003525.

Sean Miller
Sandia National Lab

Date submitted: 02 Jul 2019 Electronic form version 1.4