Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Efficacy of Computational Models of Dense Plasmas MICHAEL MURILLO, Michigan State University, MATHIEU MARCIANTE, Los Alamos National Laboratory, LIAM STANTON, Lawrence Livermore National Laboratory — Computational models must balance physics fidelity with computational cost. Because many important applications cannot be modeled with the highest-fidelity models, it is important to assess boundaries in parameter space for which lower-fidelity models still provide useful information other-wise unobtainable. Here, we perform a metastudy in which data from a wide range of computational models used in the high energy-density physics community is examined to reveal physics regimes in which they confer little advantage over simpler models. Model fidelity is measured by comparing high-fidelity predictions with new predictions from two very simple pair potential models. Error metrics are defined, and patterns in the data are sought. This data-driven approach reveals the surprising result that simpler models become applicable not because of higher temperature and/or lower density, but rather based on relative ionization level $\langle Z \rangle / Z$. Moreover, we find that the simpler models tend to fail abruptly as the role of atomic and molecular physics plays an increasing role, suggesting a fairly narrow transition between residual chemistry and disordered plasma behavior.

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Date submitted: 14 Jul 2017 Electronic form version 1.4