Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Ab-Initio Calculation of the Flux-Limiter Determining Thermal Diffusion in High Energy Density Plasmas C.P. RIDGERS, A.L. ROSSALL, University of York, R.J. KINGHAM, Imperial College London, G.J. PERT, University of York, J.J. BISSELL, University of Durham, M.M. MARINAK, Lawrence Livermore National Laboratory — Full-scale simulations of high energy density plasmas (HEDP) use approximate models models for some important plasma processes. Indeed, the inaccuracy of such models could play a role in the discrepancy between simulated and measured drive temperatures in gas filled hohlraums on the National Ignition Facility (NIF). A specific example of such a model is the application of a flux limiter to thermal transport, limiting the flux to some fraction f of the free-streaming limit which is then tuned "post hoc" to fit data from a particular experiment. The recent modification of f in NIF simulations from the more usual 0.05 to 0.15 to obtain such a fit demonstrates the limited predictive capability of a flux-limited heat flow model [1]. The value of the flux limiter is also important in direct drive inertial fusion experiments and in shock ignition and so "first-principles" calculations of the flux limiter are potentially important in many HEDP scenarios. We will show how an existing fluid code can be modified to include an ab-initio calculation of the flux limiter by replacing the energy equation with a direct solve of the kinetic Vlasov-Fokker-Planck (VFP) equation. Sample simulations of laser-solid interactions with the resulting hybrid VFP-fluid code will be presented, demonstrating for the first time that a VFP simulation framework can be used for realistic simulation of HEDP experiments.

[1] M.D. Rosen, HEDP, 180 (2011)

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Date submitted: 11 Jul 2013 Electronic form version 1.4