Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

3D extended MHD simulations of laser driven hohlraums
JEREMY CHITTENDEN, CHRIS WALSH, KRIS MCGLINCHEY, AIDAN CRILLY, ALEX SULLIVAN, Centre for Inertial Fusion Studies, Imperial College London — Magnetisation of electrons in a hohlraum plasma modifies the transport of heat from the laser absorption regions to the ablation surface and the region of soft X-ray emission and can affect the efficiency with which laser energy is converted to X-rays. Within each laser heated region, the temperature and density gradients provide a source of spontaneously generated magnetic field. For multiple overlapping beams with different intensities such as in the NIF hohlraum this process produces an intrinsically 3D and irregular magnetic field structure producing anisotropic heat flow. Similarly in experiments where external magnetic fields are applied in order to suppress thermal conduction losses within the imploding fusion capsule, this also modifies heat transport within the hohlraum. While these applied magnetic fields are initially more regular than the self-generated fields, they become contorted by the wall expansion and capsule ablation and again result in an irregular structure driving anisotropic heat flow. We present results from 2D and 3D hohlraum simulations using the extended MHD code Gorgon. A simple copper hohlraum of NIF scale is modelled using a laser ray trace model and multi-group radiation transport. Results highlight the interplay between the field generation, the anisotropic heat flow and the Nernst term. Results with externally applied fields also investigate resistive diffusion in the dense plasma regions. The contributions of other extended MHD terms such as Righi-LeDuc and Ettingshausen heat flow are also evaluated.

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Date submitted: 03 Jul 2019 Electronic form version 1.4