Coupled radiation–hydrocode and VFP code modelling of non-local transport effects in hohlraum energetics

Robert KINGHAM [1], Marty MARINAK [2], Christopher RIDGERS [3] and Jonathan BRODRICK [3]

1) Imperial College London, UK

E-mail: rj.kingham@imperial.ac.uk

2) Lawrence Livermore National Laboratory, USA

3) University of York, UK

The current 'state of the art' rad-hydrocode calculations of x-ray drive generation in indirect-drive modelling of NIF hohlraums employ a combination of the Schurtz-Nicolaï-Busquet (SNB) reduced non-local electron transport model [1] and the DCA atomic physics package. SNB removes the need for phenomenological flux-limiters and provides a description of pre-heat. Nevertheless, time dependent multipliers on the x-ray drive are still need to match implosion dynamics for hohlraums with higher density gas-fills [2], which may indicate the need to further improve these packages [3].

In an attempt to validate the SNB model in this context, we have developed the capability to couple together the rad-hydrocode HYDRA and the electron Vlasov-Fokker-Planck (VFP) code IMPACT [4], so that IMPACT can provide a more detailed non-local electron transport capability to HYDRA, particularly in the gas-fill and the wall plasma undergoing heating and ablation. We will describe the coupling approach and present calculations from a 1D surrogate hohlraum over a significant period of laser heating. The temperature evolution and X-ray emission will be compared between this and the standard modelling approach.

This builds upon our recent work where we compared non-local heat-flow determined by IMPACT and SNB from instantaneous T_e, n_e and Z^* profiles from a 1D surrogate gadolinium hohlraum. There we found discrepancies between the VFP and SNB heat-flow profiles, even after tuning the SNB model [5]. The aim here is to understand the effect of such discrepancies on an integrated calculation of X-ray drive in indirect-drive ICF.

References

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