Improvements in NLTE atomic kinetics for radiation hydrodynamics modeling of ICF hohlraums

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Post-shot simulations using recently developed (1D/2D) hohlraum models have enabled a reassessment of the accuracy of energetics modeling across a range of NIF hohlraum configurations. The higher-resolution calculations generally find that the X-ray drive discrepancies are greater than previously reported. The models also have been used to identify important physics sensitivities in the modeling of the NLTE wall plasma (see figure) and highlight sensitivity variations between different hohlraum configurations (e.g. hohlraum gas fill). These results suggest a significant fraction of the modeling discrepancies can be attributed to NLTE kinetics uncertainties. We will show how this understanding is guiding improvements in the underlying DCA [1] atomic physics package and the HYDRA [2] radiation hydrodynamics code.

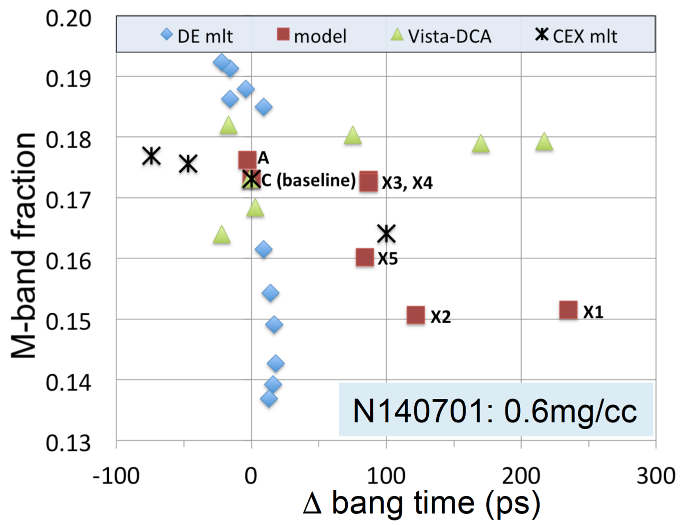

Figure 1: The 1D simulations of NIF shot N140701 (0.6mg/cc HDC target) plotted here highlight the impact of NLTE modeling parameters on energetics observables: bang time (hohlraum drive) and M-band fraction (flux > 1.8 KeV). For this platform, a multiplier on the di-electronic transitions is shown to principally impact the M-band fraction whereas changing the LTE->NLTE transition temperature significantly impacts the drive (bang time). Results using different DCA atomic models are plotted as labeled points.

References

[1] H. A. Scott, S.B. Hansen, High Energy Density Phys. 6, 39-47 (2010).
[2] M. Marinak et al., Phys. Plasmas 8, 2275 (2001).

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