Shock Velocity in ICF Ablation Material

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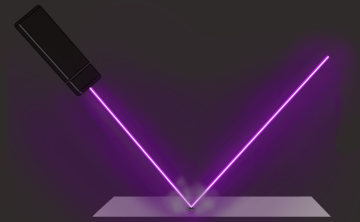


Introduction

- Direct-drive inertial confinement fusion (ICF) relies on efficient coupling of laser energy to fuel target
- The outer layer of the target is CH plastic, which ablates under the incident laser and drives an implosion
- The shock velocity in this layer is a key indicator for fusion performance, and a greater understanding of its determining factors is required

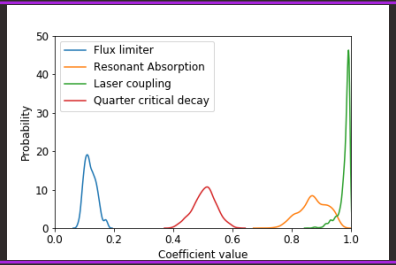
Aims

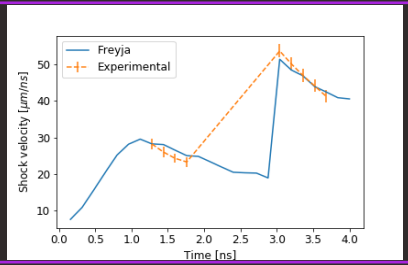
- Determine effect of laser plasma interactions (LPI) and heat flux on obtained shock velocity in CH ablation material
- Use experimental data to calibrate modelling parameters for these effects in 1D and 2D hydrodynamic codes
- Develop improved LPI and flux limiter models for the 1D code, informed by the 2D cases and experimental data

Methodology

- Experimental data for shock velocity and breakout time with planar CH foil and 4 distinct laser profiles taken from Goncharov et al. [1]
- This data used to calibrate modelling parameters in hydrodynamics codes using a combination of Gaussian process regression and Markov chain Monte Carlo techniques
- Obtained parameter posteriors for each of the experimental setups will be used to inform understanding of shock velocity as well as improved 1D models for LPI and heat flux limiter

Preliminary Results: 1D Calibration Case 4





References

[1] - Goncharov, V. N. et al. (27th Jan. 2006). ‘Early stage of implosion in inertial confinement fusion: Shock timing and perturbation evolution’. In: Physics of Plasmas13.1. Publisher: American Institute of Physics AIP, p. 012702.