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Simulations of CH ablation in direct-drive relevant conditions using a coupled electron Vlasov-Fokker-Planck and ion hydrodynamics code

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Steep temperature gradients formed in the coronal region of direct-drive inertial confinement fusion targets produce the conditions necessary for non-local electron transport, and a consequent reduction in heat flow compared to local models. In this work, simulations are carried out using the coupled VFP-hydrodynamics code K2-Gorgon, which can fully capture non-local impacts on electron heat flow in-line with the multiphysics solvers included in Gorgon. This allows detailed benchmarking of heat flow models currently used in ICF design codes, such as flux-limited diffusion and the SNB model.

Simulations were carried out in 1D using a solid plastic (CH) target with incident laser intensities of ~10^{14} W/cm^2, showing substantial differences in temperatures in the conduction region (~200 eV) compared to results from flux-limited hydrodynamics. This also leads to a change in shock properties in the CH target. Heat flux is better captured using the SNB model, but differences are still observed. This platform allows for benchmarking models across a range of target geometries and laser parameters relevant to ICF. In targets with gas fills, non-local transport leads to significant preheat, which has the potential to further alter implosion hydrodynamics. Extending this model in 2D will allow the study of magnetic field generation, which is also altered by kinetic effects, and may lead to even more complex modifications to heat flow.

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