Preliminary study of early time dynamics during pulsed laser interaction with a CH ablator target

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It is well known that a critical area of concern to inertial confinement fusion (ICF) is target nonuniformities due to their unstable growth. In direct-drive ICF experiments, the process starts when a low intensity pulse illuminates the ablator [1,2]. Three-dimensional Multiphysics finite element modelling and simulation [3] has been recently carried out to explore the influence of the thermoelastoplastic (TEP) and melting phases during the ablator's heating considering its intrinsic real TEP properties. In this work, to simulate the initial phases of solid-to-plasma transition, a ns pulsed laser interacts with a polystyrene (CH) target-sample. A 3-mm diameter 100-μm-thick planar disk of CH polymer is irradiated by a single laser beam using a pulse of 6 ns duration. The sample geometry is similar to the work in [4], where direct-drive measurements of laser-imprint-induced shock velocity nonuniformities are performed. To simulate the hydrodynamic response of the target, the first-principles equation of state (FPEOS) of polystyrene is used [5]. For the TEP mechanical response of the heated solid an accurate strength material model is considered coupled with the EOS. The results of this study aim to contribute towards the comprehension of the transition from solid to plasma phase of the target. The simulations were performed in the National HPC facility—ARIS—using the computational time granted from the Greek Research & Technology Network (GRNET) under project ID pr011027—LaMPIOS.

References

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