Poster 1 Robey

# The effects of viscosity and mass diffusion in hydrodynamically unstable plasma flows

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Hydrodynamically unstable plasma flows driven by intense laser radiation are described in which an interface between two materials of dissimilar densities is subjected to a very strong shock and then decelerated over a longer time scale. Pre-imposed perturbations on this interface are unstable to a combination of the Richtmyer-Meshkov (RM) and Rayleigh-Taylor (RT) instabilities. Overall target dimensions for these experiments are of the order of 1 mm, and length scales of the unstable perturbations of interest are as small as a few microns. At such small spatial scales, the effects of dissipative processes such as viscosity, thermal conductivity, and mass diffusion begin to affect instability growth rates.

In this study, estimates are presented of the spatial scale at which viscosity and mass diffusion begin to affect the growth of a perturbation due to the RM and RT instabilities. Time dependent values for the plasma kinematic viscosity and interfacial binary mass diffusivity are estimated for the conditions occurring in laser-driven instability experiments recently conducted on the Omega laser. These are used together with several models in the literature for estimating the reduction in the growth rate dispersion curves of the Rayleigh-Taylor and Richtmyer-Meshkov instabilities due to the presence of these small-scale dissipative effects.

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