Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

The stability of variable Atwood number flows with preferential heating in the lower layer BRYAN KAISER, Massachusetts Institute of Technology - Woods Hole Oceanographic Institution, JESSE CANFIELD, JON REISNER, Los Alamos National Laboratory — The conditions for instability in a flow consisting of two miscible, horizontal fluid strata when the lower fluid is preferentially heated by volumetric energy deposition (VED) is insufficiently understood. The flow is an approximation of the mechanical behavior of fuel capsule plasma during the compression phase of inertial confinement fusion (ICF). If the plasma becomes unstable then ignition ceases. The motivation for this study is not only to assist ICF research, but also to explore the stability of a variable Atwood number flow that develops features resembling both Rayleigh-Taylor instability and Rayleigh-Bénard instability (RBI). We use simulations to show that the instability observed in experiments can be reproduced by a stationary, spatially-variable thermal forcing and we show that the observed RBI in the bottom layer is a flow feature rather than a byproduct of imperfect experimental conditions. Paradoxically, a model by other researchers predicted the time of instability in an experiment with 2% error using a model that assumes stationary forcing in the upper layer and linearly-growing-in-time forcing the lower layer. We discuss the paradox and present a new model for predicting the time of instability that accounts for spatially-variable VED.

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Date submitted: 01 Aug 2017 Electronic form version 1.4