Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

Buoyancy instability of homologous implosions BRYAN JOHNSON, Lawrence Livermore National Laboratory — Hot spot turbulence is a potential contributor to yield degradation in inertial confinement fusion (ICF) capsules, although its origin, if present, remains unclear. In this work, a perturbation analysis is performed of an analytical homologous solution that mimics the hot spot and surrounding cold fuel during the late stages of an ICF implosion. It is shown that the flow is governed by the Schwarzschild criterion for buoyant stability, and that during stagnation, short wavelength entropy and vorticity fluctuations amplify by a factor $\exp(\pi |N_0| t_s)$, where N_0 is the buoyancy frequency at stagnation and t_s is the stagnation time scale. This amplification factor is exponentially sensitive to mean flow gradients and varies from 10^3–10^7 for realistic gradients. Comparisons are made with a Lagrangian hydrodynamics code, and it is found that a numerical resolution of $\sim$30 zones per wavelength is required to capture the evolution of vorticity accurately. This translates to an angular resolution of $\sim(12/\ell)^\circ$, or $\sim0.1^\circ$ to resolve the fastest growing modes (Legendre mode $\ell > 100$).

Bryan Johnson
Lawrence Livermore National Laboratory

Date submitted: 21 Jul 2015 Electronic form version 1.4