Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Rayleigh-Taylor Instability in non-premixed reacting flames. NITESH ATTAL, PRAVEEN RAMAPRABHU, University of North Carolina at Charlotte — The Rayleigh-Taylor instability (RTI) occurs at a perturbed interface between fluids of different densities when a light fluid pushes a heavier fluid. The mixing driven by RTI affects several physical phenomena, such as Inertial Confinement Fusion, Supernovae detonation, centrifugal combustors and liquid rocket engines. The RTI in such flows is often coupled with chemical/nuclear reactions that may form complex density stratifications in the form of flames or ablative layers. We investigate such a non-premixed fuel-air interface subject to a constant acceleration and developing under the influence of chemical reactions using high-resolution, Navier-Stokes simulations [1]. The H_2 fuel is diluted with N_2 to vary the density difference across the interface in thermal equilibrium (at 1000K). The intervening layer between fuel and air is subject to exothermic combustion reactions to form a flame. Following combustion, initially unstable fuel-air interfaces at an Atwood number (A_t) <0.5, transform into stable (fuel-flame) and unstable (flame-air) interfaces. We report on interfaces ($A_t = 0.2$ and 0.6) with single wavelength, sinusoidal perturbations and a broadband spectrum of multimode perturbations. [1] Attal, N., et al. Comput. Fluids 107 (2015): 59-76.

Nitesh Attal
University of North Carolina at Charlotte

Date submitted: 27 Jul 2015 Electronic form version 1.4