



A Study of Magnetized Deceleration-Stage Rayleigh- Taylor Growth

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Breaking down complex problems into individual topics: The Rayleigh-Taylor Instability

- The Rayleigh-Taylor instability (RTI) occurs when the light fluid is accelerated into the heavier fluid.
- Occurs in inertial confinement fusion, supernova remnants, core-collapse supernova, etc.
- An externally applied magnetic field can dampen the amount of RTI growth under the right conditions.

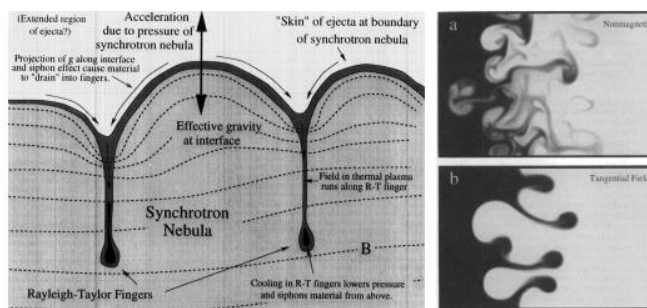
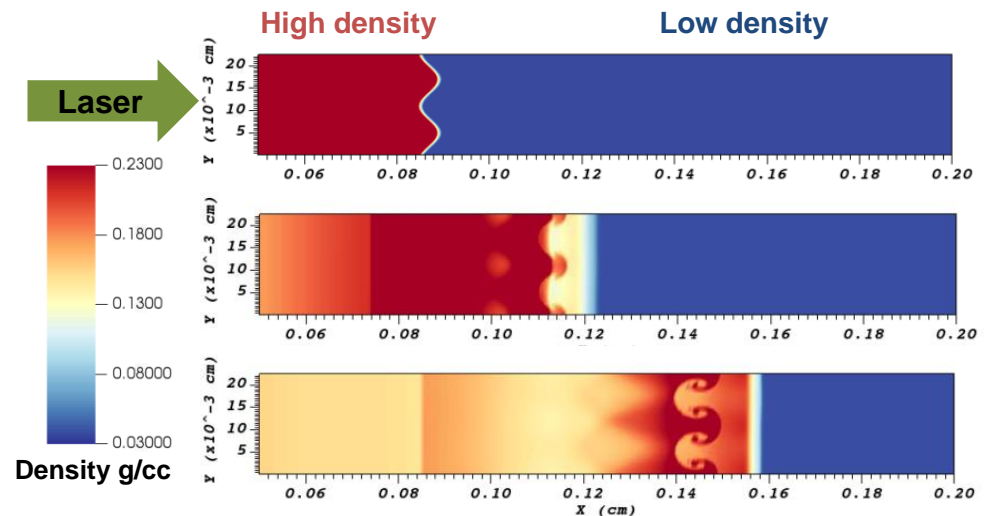
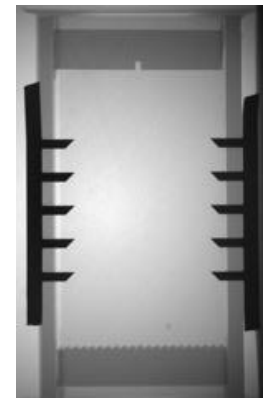
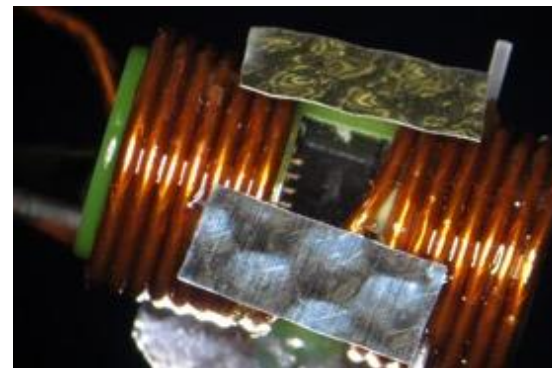
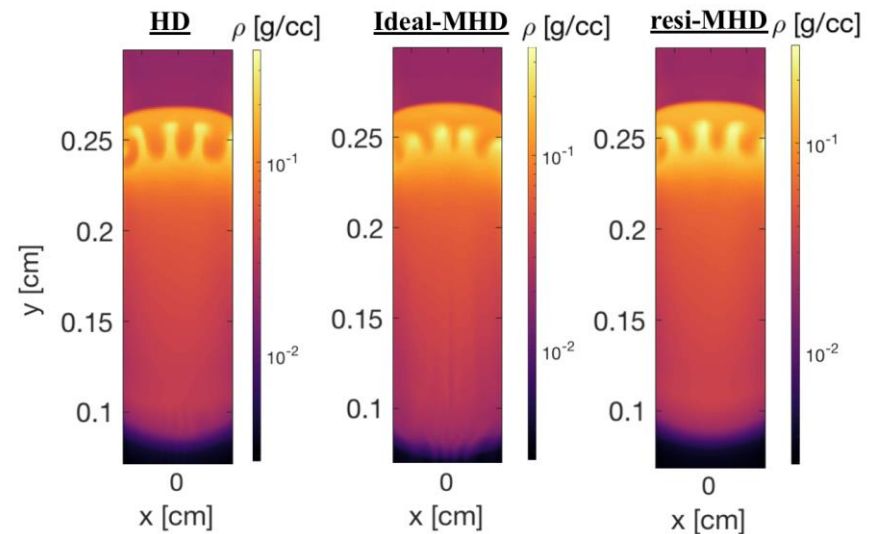


Figure 1: Reproductions from Hester (1996) [1]. Left: schematic of the RT instability in the Crab with a background B-field across the RT spikes, however, during spike evolution, the B-field is advected to align with the RT growth. Right: a) 2D-calculations of unmagnetized RT growth, b) the same conditions as a), but with a background B-field tangential to the original interface across the perturbations.



Designing a magnetized Rayleigh-Taylor experiment for the NIF

- **Experimental Goal:** Observe a measurable difference in RTI growth with and without a background magnetic field.
- **Design Parameters:**
 - 23T externally applied magnetic field
 - Doubled sided 32TW laser drives
 - High density (236mg/cc) Nickel doped foam
 - Low density (36 mg/cc) CH foam
 - Two types of perturbation
- 3 Targets were planned to produce 2 magnetized RTI data points and 4 unmagnetized RTI data points.



Post experiment simulations reveal unexpected physics at work and provide a groundwork for future experimental setups

- Preheating the target has the potential to change the RTI growth.
- The addition of a 23T background magnetic field does not damp the RTI growth in the preheated cases.
- The high-density foam interface velocity remains the same with and without the magnetic field.

