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Hydrodynamic instabilities, mixing, and turbulence in high energy density settings

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Hydrodynamic instability experiments are being developed and carried out on the National Ignition Facility (NIF) laser at LLNL through the NIF Discovery Science (basic science) program and the high energy density science (HEDS) program. The motivations are many, including star formation dynamics [1]; supernova explosion dynamics [2]; supernova remnant evolution [3]; planetary formation dynamics; asteroid impact and breakup dynamics; and the turbulent dynamo mechanism. [4] Examples include single-mode and multimode classical (non-stabilized) but compressible Rayleigh-Taylor (RT) experiments in planar geometry [5]; classical RT in single-mode cylindrically convergent geometry [6]; RT mixing into the hot spot at high compression in inertial confinement fusion (ICF) capsule implosions [7]; ablation front RT experiments in direct drive [8]; in indirect drive; and in the nonlinear RT bubble merger regime [9]. Radiative shock stabilized RT instability experiments have been developed; as have material strength stabilized RT experiments at high pressures and strain rates in solid-state ductile metals [10]. Examples will be given, connections to astrophysical and planetary science settings made; and future directions will be discussed.

References

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