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Acceleration of a Vortex Ring-Deformed Stratified Interface by a Planar Shock Wave[1] ALEX AMES, UW-Madison, CHRIS WEBER, Lawrence Livermore National Laboratory — Vortices are a well-known mechanism of transport across stratified interfaces. When repeatedly shocked, preexisting vorticity-driven deformation of the interface provides greater leverage for baroclinic torque under subsequent acceleration. The locally axisymmetric baroclinic vorticity deposition is a primary source in the turbulent energy cascade, leading to anisotropically-oriented eddies at the inertial scale, producing deleterious interfacial mixing. In particular, the assembly of a uniform fusion hotspot in inertial confinement fusion capsules is disrupted by the protrusion of a cold vortical bubble arising from the remains of the fill tube.

The morphology and evolution of compressible, variable-density vortices upon shock acceleration is explored computationally using the MIRANDA hydrodynamics code. A laboratory-scale configuration comprising a vortex ring discharged upwards into a stably-stratified layer from the open end of a small shock tube is compared for hydrodynamic similarity to a representative ICF fill tube perturbation. Vortex evolution, baroclinic production during and following shock interaction, behavior of secondary vortices, and mixing intensification are detailed across a range of vortex strengths and Atwood & Mach numbers.

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