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Vorticity dynamics in variable density flows PETER HAMLINGTON, University of Colorado, Boulder, ALEXEI POLUDNENKO, ELAINE ORAN, Naval Research Laboratory — The dynamics of vorticity in incompressible flows has been the subject of considerable research, but remains relatively poorly understood in variable density flows. Such flows include reacting and supersonic flows where the behavior of the vorticity is central to understanding the interactions between turbulence, shock waves, and flames. The variations in density across shocks and flames are often anisotropic, and here we discuss the differing effects of isotropic and anisotropic density changes on the vorticity. We focus in particular on flames and shocks, which represent different ends of the variable density spectrum; flames can create a rapid anisotropic expansion of the fluid while shocks produce a rapid anisotropic compression. These density changes result in anisotropic vorticity suppression across flames and anisotropic vorticity generation across shocks. In reacting flows, we discuss the effects of anisotropic suppression on intermittency, turbulence-flame interactions, and flame properties. We also propose a decomposition of the strain rate that allows the relative effects of turbulent and flame straining to be understood. We then compare vorticity-shock interactions with the reacting flow case and outline directions for future research.

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