

Richtmyer-Meshkov instability in inhomogeneous density materials and its application to planetary science

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Richtmyer-Meshkov instability (RMI) is a hydrodynamic interfacial instability, which occurs by the interaction between a shock wave and corrugated density jump. Because of the corrugation of the interface, the surface profiles of the transmitted and reflected shocks are also rippled. The RMI is driven by the vorticity left by these rippled shocks at the interface and in the fluid. In this study, we consider shock propagation in inhomogeneous density materials (e.g., uniform density materials with small round voids) and the turbulent growth of the interface. For these cases, the vorticity distribution and turbulent motion are much more complicated than the standard RMI cases. Then the spatial fluctuation of pressure or temperature could be significantly large after the shock passage. Using two-dimensional hydrodynamic simulations, we will examine the dependence of the pressure fluctuation on the density inhomogeneity. As the application of this numerical study, we will discuss about the shock propagation in meteorites with large density fluctuation.

Keywords: shock waves, Richtmyer-Meshkov instability