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Solenoidal scaling laws for compressible mixing[1] JOHN PANICKACHERIL JOHN, DIEGO A DONZIS, Texas A & M University, KATEPALLI R SREENIVASAN, New York University — Mixing of passive scalars in compressible turbulence does not obey the same classical Reynolds number scaling as its incompressible counterpart. In this work we first show from a large database of direct numerical simulations that even the solenoidal part of the velocity field fails to follow the classical incompressible scaling when the forcing includes a substantial dilatational component. Though the dilatational effects on the flow remain significant, our main results are that both the solenoidal energy spectrum and the passive scalar spectrum scale assume incompressible forms, and that the scalar gradient aligns with the most compressive eigenvalue of the solenoidal part, provided that only the solenoidal components are used for scaling in a consistent manner. Minor modifications to this result are also pointed out, in particular the interaction of scalar field with the dilatational part of flow field. Two parameters that are found to be important in compressible mixing are the ratio of dilatational to solenoidal rms velocities and the turbulent Mach number, whose role in mixing will also be discussed.

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