Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Emergence of scaling in compressible turbulence SUALEH KHURSHID, DIEGO DONZIS, Texas AM University, KATEPALLI SREENIVASAN, New York University — Anomalous scaling in high-Reynolds number compressible flows is a result of extreme fluctuations in velocity gradients and viscous action due to shocks. Recently it was shown that velocity gradients in incompressible turbulence undergo a transition from gaussian statistics to algebraic growth with respect to Reynolds number. This transition appears at low Reynolds numbers beyond which velocity gradients present the same behavior as turbulence at asymptotically high Reynolds numbers. Most extreme fluctuations undergo the transition first and a proper rescaling of the transition Reynolds number for different order moments of velocity gradients reveals a universal transition at Reynolds number of order 10. In this work we show that compressible turbulence, both solenoidal and dilatational modes, undergo a similar transition from gaussian at low-Reynolds to anomalous at high-Reynolds numbers. The solenoidal velocity field scales similar to its incompressible counterpart. The dilatational field, with contributions of shocklets of varying power, scales differently. The transition Reynolds number in both fields is shown to depend on the turbulent Mach number, which characterizes flow compressibility. Consequences of the scaling on nature of singularities in the two fields are discussed.

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Date submitted: 05 Aug 2020 Electronic form version 1.4