Lagrangian Statistics of Velocity-gradient in Compressible Turbulence MOHAMMAD DANISH, SAWAN SUMAN, BALAJI SRINIVASAN, Indian Inst of Tech-New Delhi — The Lagrangian-based analysis of various flow quantities, in particular the velocity-gradient tensor, has been a cornerstone in the study of turbulence. The physics of many important turbulence processes such as cascading, scalar mixing, material element deformation etc. can be explained in terms of the dynamics of velocity-gradient tensor itself. In this context, we present the Lagrangian statistics of the invariants of the velocity-gradient tensor over a wide range of Mach and Reynolds numbers in compressible turbulence. For this purpose, we track a large number of fluid particles in well resolved direct Navier-Stokes (DNS) simulations of decaying compressible turbulence. We show that these statistics significantly depend on the existence of shocklets. Specifically, we observe that the presence of shocklets tends to increase the decorrelation rate of Lagrangian autocorrelations of velocity-gradient tensor.

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