Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Turbulence generation through intense localized sources of energy[1] AGUSTIN MAQUI, DIEGO DONZIS, Texas A&M University — Mechanisms to generate turbulence in controlled conditions have been studied for nearly a century. Most common methods include passive and active grids with a focus on incompressible turbulence. However, little attention has been given to compressible flows, and even less to hypersonic flows, where phenomena such as thermal non-equilibrium can be present. Using intense energy from lasers, extreme molecule velocities can be generated from photo-dissociation. This creates strong localized changes in both the hydrodynamics and thermodynamics of the flow, which may perturb the flow in a way similar to an active grid to generate turbulence in hypersonic flows. A large database of direct numerical simulations (DNS) are used to study the feasibility of such an approach. An extensive analysis of single and two point statistics, as well as spectral dynamics is used to characterize the evolution of the flow towards realistic turbulence. Local measures of enstrophy and dissipation are studied to diagnose the main mechanisms for energy exchange. As commonly done in compressible flows, dilatational and solenoidal components are separated to understand the effect of acoustics on the development of turbulence. Further results for cases that assimilate laboratory conditions will be discussed.

[1]The authors gratefully acknowledge the support of AFOSR

Agustin Maqui
Texas A&M University

Date submitted: 31 Jul 2015 Electronic form version 1.4