

Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Turbulence generation through concentrated momentum sources¹

AGUSTIN MAQUI, DIEGO DONZIS, Texas A&M University — In many applications, thermal non-equilibrium can be a major contributor to the dynamics of turbulence. One example amenable to laboratory experiments is that of laser induced photo-dissociation of molecules, which can create fragments with very large velocities. It is of fundamental and practical interest to investigate whether this large momentum excess can be used to generate realistic turbulence. Consequently, direct numerical simulations (DNS) with concentrated momentum sources that reproduce the photo-dissociation process have been conducted to study the creation and evolution of turbulence. Two critical times are found between which the flow quickly reorganizes into fully developed turbulence. The characteristic time scales are successfully scaled with parameters related to the initial conditions and the establishment of turbulence is studied through the evolution of the velocity gradients, spectra, and anisotropy measures. Preliminary results indicate that compressible turbulence is reached at an earlier stage than incompressible. Furthermore, it is shown that higher Taylor Reynolds numbers (R_λ) can be reached for compressible flows with weaker momentum sources. Further results and consequences for particular cases realizable in laboratories will be discussed.

¹The authors gratefully acknowledge the support of AFOSR.

Agustin Maqui
Texas A&M University

Date submitted: 02 Aug 2012

Electronic form version 1.4