

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Dynamics of the tetrad-based velocity gradient in turbulent flows

HAITAO XU, Center for Combustion Energy, Tsinghua University, Beijing 100084, China and MPI Dynamics & Self-Organization (MPIDS), Goettingen 37077, Germany, ALAIN PUMIR, ENS Lyon, Lyon 69007, France, EBERHARD BODENSCHATZ, MPI Dynamics & Self-Organization (MPIDS), Goettingen 37077, Germany — We investigate the structure and evolution of turbulent flows with the help of the perceived velocity-gradient, determined from four fluid particles initially forming a regular tetrad of size r_0 . The main feature of the turbulent dynamics can be conveniently captured by a reduced description, in terms of two invariants of the velocity gradient. When r_0 is in the inertial range of scales, the evolution of averaged quantities can be parametrized by two dimensionless parameters, which vary slowly with r_0 . We also characterize the fluctuations around the conditional mean, which represent the dynamics at scales below r_0 . Using data from both Lagrangian particle tracking experiments and DNS, we show that the behavior qualitatively follows some earlier theoretical prediction, but with interesting new features.

Haitao Xu
Center for Combustion Energy, Tsinghua University,
Beijing 100084, China

Date submitted: 31 Jul 2015

Electronic form version 1.4