Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

On the kinematics of scalar iso-surfaces in a turbulent, temporally developing jet BRANDON BLAKELEY, WEIRONG WANG, DUANE STORTI, JAMES RILEY, University of Washington — The kinematics and dynamics of scalar iso-surfaces in turbulent flows is of fundamental importance for a number of problems, e.g., the stoichiometric flame surface in non-premixed combustion or the turbulent/non-turbulent interface in turbulent shear flows. We investigate the effects of turbulence on iso-surfaces by examining the surface area density, Σ, and its evolution. Using direct numerical simulation of a temporally developing jet and a novel algorithm for evaluating iso-surface properties, we report on the direct computation of Σ and the terms in its transport equation. Iso-surface properties, such as the surface area, are evaluated by converting the surface integrals to volume integrals on a regularly-sampled grid. In particular, we analyze the behavior of two different scalar iso-surfaces: the vorticity magnitude, which represents the T/NT interface in a turbulent free shear flow, and a passive scalar field which represents an inert tracer such as dye concentration or the mixture fraction. Differences between the evolution of the two iso-surfaces will be addressed, such as the production of iso-surface area due to the turbulent strain-rate and the destruction of iso-surface area due to the combined effects of diffusion and surface curvature.

Brandon Blakeley
University of Washington

Date submitted: 29 Jul 2019 Electronic form version 1.4