Date: March 28

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: Dr. Laurent Mydlarski

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Title:*"Scalar dispersion in inhomogeneous flow"*

Abstract

In the study of turbulent passive scalars, a problem of particular interest is the mixing of scalars emitted from concentrated sources. A classic example is the dispersion of a pollutant from a smokestack in the atmospheric boundary layer. Here, a scalar (the pollutant) is injected into the flow at a scale that is much smaller than the integral scale of the turbulent surroundings. Consequently, the plume emitted by the smokestack grows as it is transported downstream. Experiments, simulations and theoretical work have been devoted to furthering our understanding of this problem, though the majority have been performed in the context of homogeneous, isotropic turbulence. Given that the latter is the most fundamental turbulent flow, it continues to play a critical role in studies of turbulence. Nevertheless, it is an oversimplification of most natural or man-made flows, which are generally inhomogeneous. Therefore, the objective of the current work is to study scalar mixing from concentrated sources in fully-developed, high-aspect-ratio, turbulent channel flow. Such a flow is chosen because it is the simplest realization of an inhomogeneous turbulent flow (being inhomogeneous in one direction, and homogeneous in the other two). The effect of the flow's inhomogeneity should therefore be most evident in this configuration. The properties of the scalar field are examined by studying their mean and root-mean-square temperature profiles, probability density functions, and spectra. The results are compared to those measured in homogeneous flows. Furthermore, results pertaining to the interaction of plumes emitted from two concentrated sources are presented. Lastly, differences in wall-normal and spanwise dispersion of the scalar fields are discussed.