Date: **November 12, 2004**

Time: **10:30 AM**

Location: **Olin 305**

Speaker: **Dr. Chenning Tong**
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Title: **"Experimental Study of Subgrid-Scale Turbulent Mixing"**

Abstract

Large-eddy simulation has in recent years become a very important approach for computing turbulent combustion. In LES of nonpremixed combustion, the subgrid-scale (SGS) scalar distribution, which depends on the SGS turbulent mixing and its interaction with chemical reactions, must be modeled. Our research in recent years has been focusing on the fundamental issues of turbulent mixing in LES of nonpremixed turbulent combustion. Data obtained in turbulent jets are used to study SGS mixing. The shows that SGS mixing has qualitatively different characteristics than those generally known for fully developed turbulent flows. There are two limiting regimes of SGS mixing: the equilibrium regime and the nonequilibrium regime.

For the former the conditional SGS scalar is well mixed and the scalar dissipation depends weakly on the SGS scalar. The SGS scalar time scale is small and the SGS mechanical-to-scalar time scale ratio is large. The conditional spectral transfer of scalar variance is comparable or smaller than the filtered scalar dissipation. For the latter the conditional SGS scalar is nonpremixed, largely consisting of two scalar values separated by a sharp dissipation layer (the so-called ramp-cliff structure). The SGS scalar time scale is large and the SGS mechanical-to-scalar time scale ratio is small. The conditional spectral transfer is much larger than the filtered scalar dissipation. The nonequilibrium regime is similar to the early stages of initially binary mixing and is very different from mixing fully developed turbulent flows. Between the two limiting regimes, the conditional SGS distribution can largely be characterized by the instantaneous degree of nonequilibrium of the SGS scalar. The different mixing regimes are argued to have strong influences on the regimes of turbulent nonpremixed combustion. The results suggest that SGS mixing models need to consider the qualitatively different behaviors of the SGS scalar in the two SGS mixing regimes.