NCAR Computational & Information Systems Laboratory CISL

GTP Seminar

Modeling Interactions among Turbulence, Gas-Phase Chemistry, Soot Particles and Radiation in Flames

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Complex and sometimes subtle interactions among hydrodynamic turbulence, gas-phase chemistry, dispersed liquid and/or solid phases (e.g., fuel sprays and/or soot) and radiation heat transfer can influence performance and emissions in practical combustion systems. Modeling approaches that neglect these interactions, or that treat them in an over-simplified manner, can yield large errors in computed temperatures, heat-release and heat-transfer rates and pollutant emissions. Similar interactions are important in chemical engineering and atmospheric flows. Transported probability density function (PDF) methods provide a rational modeling framework that captures key physical processes and their interactions in a natural manner. Examples illustrating the importance of turbulence-chemistry-soot-radiation interactions (TCSRI) in laboratory flames and piston engines will be presented. The ability of PDF-based modeling approaches to accommodate realistic chemistry, detailed soot models, spectral radiation treatments and TCSRI will be demonstrated for Reynolds-averaged and large-eddy simulations. Developments aimed at reducing the high computational cost of PDF methods, and in dealing with their somewhat unconventional Lagrangian-particle-based solution algorithms, will be discussed.

Thursday, January 19, 2012

NCAR-Foothills Laboratory
3450 Mitchell Lane
Bldg 2 Auditorium (Rm.1022)
Lecture at 3:30pm