Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

DNS of High Pressure Supercritical Combustion SHAO TENG CHONG, VENKATRAMANAN RAMAN, Univ of Michigan - Ann Arbor — Supercritical flows have always been important to rocket motors, and more recently to aircraft engines and stationary gas turbines. The purpose of the present study is to understand effects of differential diffusion on reacting scalars using supercritical isotropic turbulence. Focus is on fuel and oxidant reacting in the transcritical region where density, heat capacity and transport properties are highly sensitive to variations in temperature and pressure. Reynolds and Damkohler number vary as a result and although it is common to neglect differential diffusion effects if Re is sufficiently large, this large variation in temperature with heat release can accentuate molecular transport differences. Direct numerical simulations (DNS) for one step chemistry reaction between fuel and oxidizer are used to examine the differential diffusion effects. A key issue investigated in this paper is if the flamelet progress variable approach, where the Lewis number is usually assumed to be unity and constant for all species, can be accurately applied to simulate supercritical combustion.

Shao Teng Chong
Univ of Michigan - Ann Arbor

Date submitted: 30 Jul 2016 Electronic form version 1.4