Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Direct numerical simulations of flow-chemistry interactions in statistically stationary turbulent premixed flames HONG G. IM, PAUL G. ARIAS, King Abdullah University of Science and Technology, SWETAPROVO CHAUDHURI, India Institute of Science, Bangalore, CHUNG K. LAW, Princeton University, KAUST COLLABORATION, INDIA INSTITUTE OF SCIENCE, BANGALORE COLLABORATION — The effects of Damkohler number and Karlovitz number on the flame dynamics of three-dimensional statistically planar turbulent premixed flames are investigated by direct numerical simulation incorporating detailed chemistry and transport for a hydrogen-air mixture. The mean inlet velocity was dynamically adjusted to ensure a stable flame within the computational domain, allowing the investigation of time-averaged quantities of interest. A particular interest was on understanding the effects of turbulence on the displacement speed of the flame relative to the local fluid flow. The results show that the displacement speed dynamics in response to turbulent eddies depends strongly on the specific choice of the iso-surfaces in the progress variable. As such, the statistical distribution of the flame speed versus the strain/curvature relations shows a significant sensitivity on the definition of the flame speed. Further analysis is conducted to examine the behavior of the alignment between the flame surface and the strain rate eigenvectors. The results for the reference conditions are compared against different parametric conditions in order to assess their effects on flame-flow interaction characteristics.

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Date submitted: 02 Aug 2014 Electronic form version 1.4