Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Similarity and Scaling of Turbulent Flame Speeds for Expanding Premixed Flames of C_4-C_8 n-alkanes[1] FUJIA WU, ABHISHEK SAHA, SWETAPROVO CHAUDHURI, SHENG YANG, CHUNG K. LAW, Princeton University — We experimentally investigated the propagation speed of constant-pressure expanding flames in near isotropic turbulence using a dual-chamber, fan-stirred vessel. The motivation is to test whether the fuel similarity concept among C_4-C_8 n-alkanes on laminar flames also holds for turbulent flames. Previously it was found that the laminar flame speed and Markstein length are almost identical for C_4-C_8 n-alkanes. If this fuel similarity concept can also be shown for turbulent flames, it will suggest a canonical flame structure for large hydrocarbon fuels, *i.e.*, large fuels always decompose to small C_0-C_4 fuel fragments before being oxidized, and would significantly simplify the description of the flames. Preliminary results show that in the flamelet and thin-reaction zone, turbulent flame speeds of C_4-C_8 n-alkanes are indeed largely similar at various conditions, thereby suggesting the fuel similarity for turbulent flames. In addition, it is found that the normalized turbulent flame speed also approximately scales with the square root of an appropriately-defined Reynolds number recently found for C_0-C_4 fuels.

[1]This work was supported by the AFOSR under the technical monitoring of Dr. Chiping Li.

Fujia Wu
Princeton University

Date submitted: 30 Jul 2013 Electronic form version 1.4