Analysis of 3D turbulent flame surface measurements

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visiting

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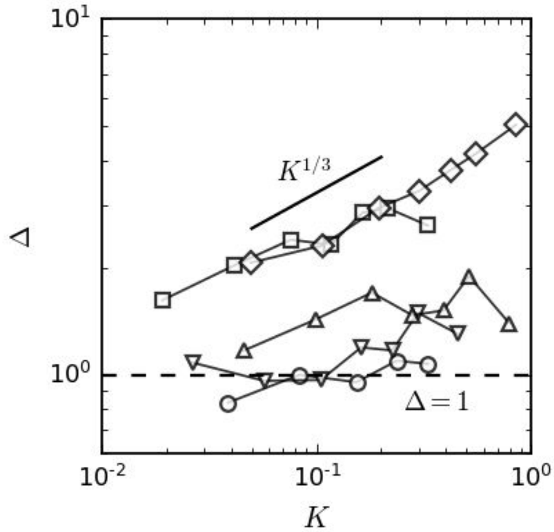
April 5—11, 2019 and May 17—20, 2019

The Short Research Visit was completed in two parts. In the first part, experimental measurements obtained in Leeds were verified in order to validate a theory developed in Cambridge [1]. Central to the theory is the ratio Δ of the turbulent flame speed and turbulent flame surface area. Based on 2D measurements alone, the ratio Δ is tends to be unity [2], but the theory predicts Δ to increase with a non-dimensional parameter K, the Karlovitz stretch factor. The advancement of a swinging-laser-sheet technique in Leeds provides for the first time 3D measurements of the flame surface that render unnecessary the assumption of isotropy adopted in 2D measurements for evaluating the flame surface area. The ratio Δ evaluated based on 3D measurements as verified during the SRV is shown in the Figure below for a range of burning mixtures (separate curves). Verification of these values was essential as they differ significantly from previous 2D measurements, but are in line with the recent theory developed in Cambridge.



The verified Figure is confirmation that Δ increases with K in line with the theory for some of the flames when 3D measurements are used. For the remaining flames, Δ tends to be close to unity. The reasons that delineate the flames into two categories is the subject of further research.

In the second part of the SRV, the data were interpreted further and a manuscript was drafted reviewing the key outcomes. This included the exchange of necessary details between the groups concerning the experimental method and theoretical framework. A preliminary draft of the manuscript has been put forward, and is to be shared between the groups over the coming weeks.

The SRV allowed for an in-depth research exchange, not normally possible through remote communication.

[1] Nivarti, G. V. and Cant, R. S. and Hochgreb, S. *Journal of Fluid Mechanics Rapids* (2019) 858:R1
[2] Peters, N. *Turbulent Combustion* (2000) Cambridge University Press