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Multiscale Geometry and Fractal Scaling of Spherically Expanding Turbulent Premixed Flames[1] TEJAS KULKARNI, FABRIZIO BISETTI, The University of Texas at Austin — The burning rate in combustion devices operating under turbulent conditions is typically dictated by the flame surface area. A turbulent flame is stretched, folded, and wrinkled on a multitude of length scales ranging from the Kolmogorov scale to the integral scale. Consistently with studies on interfaces in isothermal turbulence, it has been postulated that turbulent flame surfaces exhibit scale-invariant or fractal properties. In this study, we investigate the fractal nature of the surface of several turbulent spherical flames subject to decaying turbulence at varying Reynolds number. We find that the flame surface has a fractal dimension that varies in time, remaining close to 2.4, although the limited size of the inertial range makes a more specific attribution difficult. The inner cut-off length is found to be equal to about 10 Kolmogorov lengths and about the same size as the Taylor miscroscale. The cut-off length can be interpreted as the characteristic scale of surface wrinkling processes and is found to be be nearly independent of the Reynolds number. Our results are compared with others in the literature.

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