Abstract Submitted
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Multiscale geometry, scaling and fluxes at the turbulent/non-turbulent interface in high Reynolds number boundary layers[1] CHARLES MENEVEAU, Johns Hopkins University, CHARITHA M. DE SILVA, JIMMY PHILIP, KAPIL CHAUHAN, IVAN MARUSIC, University of Melbourne — The scaling and surface area properties of the wrinkled surface separating turbulent from non-turbulent regions in open shear flows are important to our understanding of entrainment mechanisms at the boundaries of turbulent flows. PIV data from high Reynolds number turbulent boundary layers covering three decades in scale are used to resolve the turbulent/non-turbulent interface experimentally and to determine unambiguously that such surfaces exhibit fractal scaling with box-counting exponent between -1.3 and -1.4. A complementary analysis based on spatial filtering of the velocity fields also shows power-law behavior of the coarse-grained interface length as a function of filter width, with an exponent between -0.3 and -0.4. These results establish that the interface is fractal-like with a multiscale geometry and fractal dimension of D $\sim$ 2.3-2.4. Measurements of viscous, subgrid-scale and turbulent fluxes across the interface at various scales confirm the complementary nature of viscous nibbling at small scales while turbulent and then large-scale engulfment dominate when viewed at large scales.

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Charles Meneveau
Johns Hopkins University

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