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Scaling of the viscous superlayer in zero pressure gradient turbulent boundary layers KAPIL CHAUHAN, JIMMY PHILIP, IVAN MARUSIC, The University of Melbourne — Scaling of the viscous superlayer (a thin region that exists at the interface of a turbulent boundary layer and a non-turbulent free-stream) is sought using theoretical reasoning and experimental evidence. A kinetic energy criteria is successfully utilised to identify the turbulent/non-turbulent interface over two-dimensional velocity fields in the streamwise/wall-normal plane. The data-analysis utilises particle image velocimetry measurements at four different Reynolds numbers ($\delta^+ = \delta u_\tau/\nu$=1200-14500). The presence of a viscous superlayer is illustrated in all four data sets. It is found that the mean normal velocity across the interface and the tangential velocity jump scales with the skin-friction velocity u_τ. The width of the superlayer is characterised by the local vorticity thickness δ_ω and scales with the viscous length scale ν/u_τ. An order of magnitude analysis of the tangential momentum balance within the superlayer indicates that the turbulent motions also scale with inner scaling, i.e. u_τ and ν/u_τ are the velocity and length scales, respectively.

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