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Turbulent superstructures in a zero pressure gradient turbulent boundary layer for the Mach number range 0.3 − 3.0[1] MATTHEW BROSS, SVEN SCHARNOWSKI, CHRISTIAN J. KÄHLER, Bundeswehr University Munich — Meandering high- and low-momentum flow motions often called superstructures in turbulent boundary layers (TBLs) can extend up to several boundary layer thicknesses and contain a large portion of the layer's turbulent kinetic energy. However, compared to the extensive number of incompressible investigations much less is known about the structural characteristics for compressible TBLs. Therefore, in this investigation TBLs on a flat plate over a range of Reynolds numbers and Mach numbers are considered in order to investigate the effect of compressibility on superstructures. Measurements are performed in the Trisonic Wind Tunnel Munich (TWM) for $0.3 < \mathrm{Ma} < 3.0$ and a friction Reynolds number of $2700 < \mathrm{Re}_\tau < 14800$ or $19800 < \mathrm{Re}_{\delta_2} = \rho_e u_e \theta^* / \mu_\mathrm{w} < 40800$. Velocity fields are recorded using planar particle image velocimetry methods (PIV and stereo-PIV) in three perpendicular planes. Using multi-point statistical and spectrogram methods it was found that the streamwise wave lengths associated with superstructures in the log-law layer slightly increase with Mach number and a distinct increase in the spanwise spacing of these structures was found for the supersonic cases when compared to the subsonic and transonic cases

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