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Large-scale coherence in a supersonic turbulent boundary layer BHARATHRAM GANAPATHISUBRAMANI, NOEL. T CLEMENS, DAVID S. DOLLING, Center for Aeromechanics Research, University of Texas at Austin, TX 78712 — Wide-field particle image velocimetry measurements were performed in a Mach 2 turbulent boundary layer to study the characteristics of large scale coherence at two wall-normal locations ($y/\delta = 0.16$ and 0.45). Instantaneous velocity fields at both locations indicate the presence of elongated streamwise strips of uniform low- and high-speed fluid (length $> 8\delta$). These long coherent structures exhibit strong similarities to those that have been found in subsonic boundary layers, which suggests an underlying similarity between the subsonic and supersonic regimes. Two-point correlations of streamwise velocity fluctuations show coherence over a longer streamwise distance at $y/\delta = 0.45$ than at $y/\delta = 0.16$, which indicates an increasing trend in the streamwise length scale with wall-normal location. The spanwise scale of these uniform velocity strips increases with increasing wall-normal distance as found in subsonic boundary layers. The large scale coherence is consistent with the presence of "hairpin packets" (a model previously proposed for subsonic boundary layers).

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