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The effect of concave surface curvature on supersonic turbulent boundary layers[1] CHRISTIAN LAGARES, HPCVLab U. of Puerto Rico-Mayaguez, KENNETH JANSEN, U. of Colorado-Boulder, GUILLERMO ARAYA, HPCVLab U. of Puerto Rico-Mayaguez — Unsteady 3D turbulent boundary layers that evolve along the flow direction exhibit a streamwise non-homogeneous condition and pose enormous computational challenges. The reasons are as follows: (i) full spectrum resolution of turbulence, (ii) accurate time-dependent inflow turbulence information, and (iii) compressibility effects. Moreover, accounting for the effects of wall-curvature driven pressure gradient adds significant complexity to the problem. In this presentation, we will show recent Direct Numerical Simulation (DNS) with high spatial/temporal resolution of supersonic spatially-developing turbulent boundary layers (SDTBL) subject to strong concave curvature (δ_{inlet}/R $\approx$ -0.083, R is the curvature radius) and Mach = 2.86, which are of crucial importance in aerospace applications (e.g. unmanned high-speed vehicles and scramjets). The prescribed curved geometry is based on the experimental study by Donovan et al. (J. Fluid Mech., 259, 1-24, 1994). Turbulent inflow conditions are based on extracted data from a previous DNS over a flat plate (precursor). The extensive DNS information will shed important light on the transport phenomena inside turbulent boundary layers subject to strong deceleration or Adverse Pressure Gradient (APG) caused by concave walls.

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