Abstract Submitted
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Thermal transport in hypersonic turbulent boundary layers at high-Reynolds numbers[1] JEAN SANTIAGO, HPCVLab U. of Puerto Rico-Mayaguez, NATHAN TICHENOR, Texas A&M University, GUILLERMO ARAYA, HPCVLab U. of Puerto Rico-Mayaguez — The evolution of thermal spatially-developing turbulent boundary layers (SDTBL) is studied experimentally and numerically at the hypersonic regime. Experiments were performed in a high-speed blow-down wind tunnel facility located in the National Aerothermochemistry and Hypersonics Laboratory (NAL) at Texas A&M University (TAMU) over a zero-pressure gradient (ZPG) adiabatic flat plate at a Mach number of 4.9 and a Reynolds number of 9,000 based on freestream density, momentum thickness, freestream velocity and wall viscosity. Direct Numerical Simulation (DNS) and Large Eddy Simulation (LES) of SDTBL at low and high Reynolds numbers are designed in harmony with experiments. Turbulent inflow information is generated via the dynamic rescaling-recycling approach (J. Fluid Mech., 670, pp. 581-605, 2011), which is extended to compressible flows. DNS and LES results of the velocity field are validated by particle image velocimetry (PIV) experiments. Focus is given to the assessment of Reynolds number on the thermal fluctuations and turbulent heat fluxes, as well as their vertical transport. This presentation will emphasize the calibration effort of the numerical model in order to capture the measured flow structure.

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