Abstract Submitted
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High-speed boundary layer transition induced by a discrete roughness element[1] PRAHLADH IYER, KRISHNAN MAHESH, University of Minnesota — The effect of a hemispherical bump on a Mach 3.37 laminar boundary layer is studied using DNS for three conditions with $k/\delta = 2.54$, 0.25 and 0.125, where k is the roughness height. The simulation parameters are based on the experiment by Danehy *et. al.* (AIAA-2009-394). The flow downstream of the roughness is transitional for all the three conditions accompanied by a rise in skin friction and heat transfer. Upon interaction with the roughness element, the boundary layer separates to form a series of spanwise vortices upstream and a shear layer. These vortices wrap around the roughness to yield a system of streamwise vortices downstream. Perturbation of the shear layer due to the vortices results in the formation of hairpin-shaped vortices further downstream of the roughness. While hairpin vortices were observed in both the center plane and off-symmetry planes on either side for the smallest δ case, they were observed only in the center plane for the other cases.

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