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Time-Resolved Planar Velocimetry of the Supersonic Wake of a Wall-Mounted Hemisphere STEVEN BERESH, JOHN HENFLING, RUSSELL SPILLERS, Sandia National Laboratories — Time-resolved particle image velocimetry (PIV) was conducted at 40 kHz using a pulse-burst laser in the supersonic wake of a wall-mounted hemisphere. Velocity fields suggest a recirculation region with two lobes in which flow moves away from the wall near centerline and recirculates back towards the hemisphere off centerline. Spatio-temporal cross-correlations and conditional ensemble averages relate the characteristic behavior of the unsteady shock motion to the flapping of the shear layer. At Mach 1.5, oblique shocks form associated with vortical structures in the shear layer and convect downstream in tandem; a weak periodicity is observed. Shock motion at Mach 2.0 appears somewhat different, wherein multiple weak disturbances propagate from shear layer turbulent structures to form an oblique shock that ripples as these vortices pass by. Bifurcated shock feet coalesce and break apart without evident periodicity. Power spectra show a preferred frequency of shear layer flapping and shock motion for Mach 1.5, but at Mach 2.0 a weak preferred frequency is found only for the oblique shock motion and not the shear layer unsteadiness.

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