Shocking Interactions

In supersonic flows, shockwave boundary layer interactions are a primary source of technical uncertainty and risk. Such interactions create regions of intense heating and fluctuating pressure. These phenomena are especially volatile when shockwaves interact with transitional boundary layers which are already undergoing intermittent state change. Understanding the dynamic behavior of these interactions is a vital need for the development of emerging high-speed aerospace systems.

In this schlieren image, a transitional shockwave boundary layer interaction has been generated using a 1/8-inch diameter cylinder on a 20-degree half-angle cone in a Mach 2.3 freestream. Near the cone surface, the bow shock of the cylinder interacts with the boundary layer causing a bifurcation of the shockwave and flow separation in the underlying region. Due to the transitional nature of the boundary layer, the interaction is unsteady, and the extent of separation changes in response to the state of the incoming boundary layer. The resultant local, unsteady thermal and mechanical loads are responsible for some of the most intense surface conditions experienced by the vehicle surface. Also, visible in this image are several shock-shock interactions where the cone and cylinder bow shocks intersect.

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