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Boundary-layer transition via spatially growing oblique waves OLAF MARXEN, Univ of Surrey — External laminar flow over the surface of a slender body is often convectively unstable so that high-frequency traveling streamwise waves in the boundary layer grow exponentially downstream. In particular, spatially growing oblique waves may initiate laminar-turbulent boundary-layer transition if the boundary layer is separated or at supersonic speeds. Such a transition scenario is investigated by means of direct numerical simulations for these two conditions. Despite certain similarities characteristic for breakdown caused by oblique waves, such as the non-linear growth of steady streamwise streaks, the breakdown mechanism is found to be fundamentally different in the two cases. The incompressible separated boundary layer undergoes wave breakdown, i.e. non-linear waves assume the form of spanwise vortices and are susceptible to instabilities of the vortex core or the braid region, causing breakdown. In the supersonic case, streak breakdown occurs instead, leading to a sinuous motion of the low-speed streak.

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