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Spatio-temporal dynamics of pressure-induced turbulent separation bubbles[1] WEN WU, CHARLES MENEVEAU, RAJAT MITTAL, Johns Hopkins University — The spatio-temporal dynamics of separation bubbles (SBs) induced to form in a fully-developed turbulent boundary layer over a flat plate are studied via direct numerical simulations. Two different SBs are examined: one induced by a suction-blowing velocity profile on the top boundary and the other, by a suction-only velocity profile. The latter condition allows reattachment to occur without an externally imposed favourable pressure gradient and leads to a SB more representative of those occurring over airfoils and in diffusers. The suction-only SB exhibits a range of clearly distinguishable modes. The high-frequency modes are well characterized by classical frequency scalings for a plane mixing layer and are associated with the formation and shedding of spanwise oriented vortex rollers. The topology associated with the low-frequency motion is revealed by the application of dynamic mode decomposition (DMD) and is shown to be dominated by highly elongated structures in the streamwise direction. The possibility of Görtler instability as the underlying mechanism for these structures is explored.

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