

Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Characteristics of turbulent spots in transitional boundary layers OLAF MARXEN, Univ of Surrey, TAMER ZAKI, Johns Hopkins University — The laminar-turbulent transition process in a flat-plate boundary layer beneath free-stream turbulence takes place through the inception and spreading of confined patches of turbulence in an otherwise laminar flow. These patches, also referred to as turbulent spots, result from a secondary instability of the Klebanoff streaks in the pre-transitional region. The dynamics of turbulence in the spots are investigated by analyzing data sets obtained from direct numerical simulations. Conditionally-averaged and spot-ensemble-averaged statistics are evaluated and describe the flow in the intermittent transition zone. Both mean-flow and disturbance root mean square levels obtained from conditional averaging agree very well with results for fully turbulent flows, in particular near the wall and at high intermittency levels. At relatively low intermittency, the spatial inhomogeneity of turbulence within the spots is important, and is examined using ensemble averaging of turbulent patches that have comparable volume and a similar streamwise location.

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Date submitted: 31 Jul 2015

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