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Self-sustained localized structures in a boundary-layer flow identified by edge tracking DAN HENNINGSON, Linne FLOW Centre, KTH Mechanics, YOHANN DUGUET, LIMSI-CNRS, Paris, PHILIPP SCHLATTER, Linne FLOW Centre, KTH Mechanics, BRUNO ECKHARDT, Philipps-Universität Marburg — When a boundary layer starts to develop spatially over a flat plate, only disturbances of sufficiently large amplitude survive and trigger turbulence subcritically. Direct numerical simulation of the Blasius boundary-layer flow in a long and wide domain is carried out to track the dynamics in the region of phase space separating transitional from relaminarizing trajectories. In this intermediate regime, the corresponding disturbance is localized both in streamwise and spanwise directions, and spreads slowly in space. This structure is dominated by a robust pair of low-speed streaks, whose convective instabilities spawn hairpin vortices evolving downstream into transient disturbances. In contrast to previous work we find that the hairpin vortices are dynamically insignificant. A quasicyclic mechanism for the generation of offspring is unfolded using dynamical rescaling with the local boundary-layer thickness. The obtained quasi-cyclic character may be interpreted as an approach to an edge state in a spatially developing boundary layer. [PRL 108, 044501, 2012]

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