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Experimental observation of the edge state in pipe flow ALBERTO DE LOZAR, Max Planck Institute for Dynamics and Self-Organization, FERNANDO MELLIBOVSKY, Universitat Politecnica de Catalunya, BJOERN HOF, Max Planck Institute for Dynamics and Self-Organization — Transition to turbulence in pipe flow is subcritical and therefore laminar and turbulent flows are observed at the same Reynolds number. Recent numerical studies have identified the hyper-surface in phase space which divides trajectories leading to laminar or turbulent state. Surprisingly, a single chaotic attractor (called edge state) controls the flow dynamics on this hyper-surface. It has been suggested that edge state may play an important role for transition to turbulence but up to now there is no experimental evidence to support this claim. Our goal is to look for possible signatures of edge dynamics in decaying turbulence. In a recent paper we demonstrated that turbulence at low Reynolds can be forced to decay. In our experiments we study the flow in this decaying section using two stereo PIV systems enabling us to measure velocities in two planes separated by 6 diameters. We correlate the experimentally measured velocity fields with the numerically calculated edge state. Surprisingly the experiment closely resemble the edge state for 17% of the time. Additionally, the phase velocity in the experiment closely matches the traveling wave solution underlying the edge state.

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