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Dynamics on the laminar-turbulent boundary and the origin of the maximum drag reduction asymptote in polymer solutions MICHAEL GRAHAM, Univ. of Wisconsin-Madison, LI XI, Massachusetts Institute of Technology — Dynamical trajectories on the boundary in state space between laminar and turbulent plane channel flow – edge states – are computed for Newtonian and viscoelastic fluids. Viscoelasticity has a negligible effect on the properties of these solutions, despite the fact that their mean velocity profiles correspond closely to what is observed in experiments with drag-reducing polymer solutions in the maximum drag reduction regime. These results confirm the existence of weak turbulence states that cannot be suppressed by polymer additives, explaining the fact that there is an upper limit for polymer-induced drag reduction. The universality of this limit with regard to polymer properties arises from the fact that the edge states are too weakly three-dimensional to lead to persistent stretching of polymer chains.

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