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Fast and slow transition to turbulence in plane Poiseuille flow BRUNO ECKHARDT, STEFAN ZAMMERT, Philipps-Universitat Marburg — Plane Poiseuille flow has two paths to turbulence: a slow one connected with a linear instability to Tollmien-Schlichting waves at Reynolds numbers above 5772, and a fast one through a by-pass transition at much lower Reynolds numbers. We explore the conditions for the two transition scenarios and their connections in the state space of the system by tracking the time evolution of different perturbations, i.e. we use the edge tracking algorithm for the identification of edge states (PRL 96, 174101 (2006)). We identify the two travelling waves that govern the transition process and study their subcritical bifurcations. The fast transition is realized for a large set of initial conditions as soon as it appears. The slow transition process first appears in a very thin slice that grows with Reynolds number but becomes noticeable only shortly before the linear instability. Both transition paths are shown to converge to the same turbulent state.

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