Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

The edge of chaos as a Lagrangian Coherent Structure[1] MIGUEL BENEITEZ, KTH Royal Institute of Technology, YOHANN DUGUET, LIMSI CNRS, PHILIPP SCHLATTER, DAN S. HENNINGSON, KTH Royal Institute of Technology — The linear stability analysis of many shear flows e.g. plane Couette flow, indicates that no infinitesimal perturbations grow exponentially. However, it is known that for such flows transition to turbulence occurs for perturbations of a finite amplitude. The state space of such systems is structured around a dividing manifold called the edge, which separates trajectories attracted by the laminar state from those reaching the turbulent state. We apply here concepts and tools from Lagrangian data analysis to investigate this edge manifold. In this work the edge manifold is re-interpreted as a hyperbolic Lagrangian coherent structure, being the locally most repelling surface in state space. Two different diagnostics, finite-time Lyapunov exponents (FTLEs) and Lagrangian Descriptors, are used and compared with respect to their ability to identify the edge and to their scalability. Their properties are illustrated on several low-order models of subcritical transition of increasing dimension and complexity, as well on well-resolved simulations of the Navier-Stokes equations in the case of plane Couette flow.

[1]Financial support by the Swedish Research Council (VR) grant no. 2016-03541 is gratefully acknowledged

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Date submitted: 03 Aug 2020 Electronic form version 1.4