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Tomographic PIV Observations of Turbulent Structures in Transitional Taylor-Couette Flow[1] DANIEL BORRERO, MICHAEL SCHATZ, Center for Nonlinear Science and School of Physics, Georgia Institute of Technology — Theoretical and numerical studies have suggested that unstable, exact solutions of the Navier-Stokes equations known as Exact Coherent Structures (ECS) may provide a foundation for a simplified dynamical description of turbulence. Taylor-Couette flow (TCF) is an ideal system to make experimental connections to current ECS theory since it maintains some of its assumptions (streamwise periodic boundary conditions and plane Couette flow (in the small-gap limit)), but also includes realistic effects (no-slip spanwise boundary conditions). Furthermore, when only the outer cylinder is allowed to rotate, the system exhibits a subcritical transition to turbulence much like the one that the systems used to develop ECS theory undergo. We have developed a Taylor-Couette system with a series of jets built into the inner cylinder wall, which we can use to make small, local perturbations to the flow. We use tomographic particle image velocimetry to measure the structures that form when the flow is perturbed and how these structures affect the stability of the laminar flow in the transitional regime.

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