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Symmetry Broken Exact Coherent Structures in Plane Couette Flow VARCHAS GOPALASWAMY, Reed College, University of Rochester, DANIEL BORRERO-ECHEVERRY, Reed College — Invariant solutions of the fully resolved Navier-Stokes equation, known as exact coherent structures (ECS) are an exciting and potentially revolutionary method for understanding turbulent dynamics. The geometry of plane Couette flow leads to the existence of ECS with a high degree of symmetry. However, turbulent flows do not display a high degree of symmetry, so it is unclear whether these symmetric ECS can truly capture the turbulent dynamics. We report the discovery of four new periodic orbits – P85 and P60 which are fully symmetric, and P32 and P8, which have partially broken symmetry. Projections of these periodic orbits in the dissipation-energy input plane reveal that P32, P60 and P85 lie in the turbulent region of the state space, whereas P8 lies very far away from this region. Parametric continuation in the spanwise periodic cell length L_z suggests that P8 undergoes two bifurcations, which are verified by analysis of various properties of P8 in the dissipation-energy input plane, and by observations of changes in the stability of eigenvectors that are consistent with bifurcations.

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