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Laboratory measurements of Exact Coherent Structures in 2D and 3D Turbulence[1]

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Recent theoretical advances suggest ways to find unstable exact Navier Stokes solutions that capture many features of coherent structures, which have long been observed in turbulent flow. At present, it remains unknown whether these solutions, termed Exact Coherent Structures, can describe observations of turbulent flow in laboratory experiments. We describe experimental measurements of Exact Coherent Structures in two settings: (1) quasi-2D flows driven by electromagnetic forces and (2) shear-driven turbulence in circular Couette flow. In both cases, time series of velocity fields are obtained from images of the visualized flow. Analysis of velocity field data provides evidence for the existence of Exact Coherent Structures in the form of unstable fixed points and periodic orbits.

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