

Abstract Submitted  
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**Almost-invariant sets as “ghost rods” for fluid stirring** MARK STREMLER, PANKAJ KUMAR, PIYUSH GROVER, SHANE ROSS, Virginia Tech — In two-dimensional time-dependent flows or three-dimensional flows with a certain symmetry, the braiding of periodic orbits provides a framework for analyzing chaos in the system through application of the Thurston-Nielsen (TN) classification theorem. “Ghost rods,” or periodic orbits generated by the dynamics, behave as physical obstructions that “stir” the surrounding fluid, and these can be used as the basis for this topological analysis. We explore the identification of almost-invariant sets, or regions of fluid with high local residence time, as ghost rods. This set-oriented approach can be applied using relatively coarse system information, making this a promising approach for extending the use of the TN classification theorem to a variety of fluid systems.

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