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Describing Chaotic Dynamics in Experimental Rayleigh-Bénard Convection Using Persistent Homology Theory[1] JEFFREY TITHOF, BALACHANDRA SURI, Georgia Institute of Technology, MIROSLAV KRAMAR, VIDIT NANDA, Rutgers University, MU XU, MARK PAUL, Virginia Tech, KONSTANTIN MISCHAIKOW, Rutgers University, MICHAEL SCHATZ, Georgia Institute of Technology — We employ a new technique for describing the dynamics of spatiotemporal chaos in Rayleigh-Bénard convection. We collect shadowgraph images of multiple time series of weakly chaotic flows, each starting from similar initial conditions which we impose using a laser. We then encode the topological characteristics of each frame into a so-called persistence diagram, measure the distance across all diagrams, and study the dynamical behavior. Results are compared to similar analyses of simulation data. This new methodology provides unique insight into the time evolution of this dynamical system and the chaotic evolution across separate runs, in both experiment and simulation.

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