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Attractor Identification from Empirical Data Using Diffusion-Mapped Delay Coordinates ZRINKA GREGURIC FERENCEK, TYRUS BERRY, TIMOTHY SAUER, JOHN CRESSMAN, George Mason University — Nonlinear driven system can exhibit a diverse range of dynamics, from highly ordered to chaotic. These systems are ubiquitous, from atmospheric phenomena to brain function. In many cases, the governing equations for these systems are unknown. Here we present a dimensionality reduction algorithm based on diffusion-mapped delay coordinates that identifies the dimension and volume of the system's underlying attractor from empirical data. We generate data in the form of movies that are governed by the Rössler and Lorenz systems, as well as purely noisy and simple period dynamics. We show that this algorithm can be used to identify the dimensionality and volume of these attractors from empirical data. We then go on to apply this algorithm to a small electroconveting liquid crystals that supports multistable states that are characterized by patterns of creation, evolution, and annihilation of defects in the sample. We are able to identify the dimension and volume of their dynamics and use them to discriminate between these states.

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