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**Curvature Fields, Topology, and the Dynamics of Spatiotemporal Chaos**[1] JERRY GOLLUB, NICHOLAS OUELLETTE, Haverford College — Identifying the dynamically relevant degrees of freedom in a spatiotemporally chaotic flow has proved to be challenging. Here, we show a novel way to identify the time-dependent topologically special points of a flow that exhibits spatiotemporal chaos, and we suggest that they can be used to describe the flow as a whole. We produce the flow by electromagnetic forcing of a thin conducting fluid layer above a square array of disk magnets. The fluid is driven into a regime of spatiotemporal chaos. We measure the instantaneous velocities and accelerations of tracer particle trajectories using accurate particle tracking, and use them to construct the local curvature field. We show that the points of locally high curvature correspond to the hyperbolic (stagnation) points and elliptic points (regions of local rotation). The value of the Okubo-Weiss parameter allows them to be distinguished from each other. These special topological points can be accurately tracked over time. When the forcing is weak, they are pinned to the forcing magnet array, but for stronger forcing they wander over the flow domain and can be created and annihilated. Their behavior reveals a two-stage transition to spatiotemporal chaos: a gradual loss of spatial and temporal order followed by an abrupt onset of topological changes.

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