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Lagrangian Coherent Structures are templates for reaction initiation between initially distant scalars[1] KENNETH PRATT, JAMES MEISS, JOHN CRIMALDI, Univ of Colorado - Boulder — Lagrangian Coherent Structures (LCS) are shown to be effective templates for the location of reactions between initially distant scalars in 2D flows. Computations of reactions and finite-time Lyapunov exponent (FTLE) fields demonstrate that reactions are initiated when the scalars come into contact on a common FTLE ridge at a time that depends upon the initial condition. To show robustness of the phenomenon, a hierarchical set of three numerical flows is used: the periodic wake downstream of a stationary cylinder, a chaotic double gyre flow, and a chaotic, aperiodic flow consisting of interacting Taylor vortices. Coalescence of highly concentrated filaments leads to transient reaction rates that are orders of magnitude greater than predicted by the well-mixed state. As a consequence, we show that chaotic flows, known for their ability to efficiently dilute scalars, also have the competing effect of organizing initially distant scalars along the LCS at timescales shorter than that required for dilution.

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