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Burning invariant manifolds in spatially disordered advection-reaction-diffusion[1] DYLAN BARGTEIL, Bucknell University/University of Maryland, TOM SOLOMON, Bucknell University, JOHN MAHONEY, KEVIN MITCHELL, University of California, Merced — We introduce burning invariant manifolds (BIMs) which act as barriers to front propagation, similar to the role played by invariant manifolds as barriers to passive transport in two-dimensional flows. We present experimental studies of BIMs in a spatially disordered, time-independent flow. We generate the flow with a magnetohydrodynamic technique that uses a DC current and a disordered pattern of permanent magnets. The velocity field is determined from this flow using particle tracking velocimetry, and reaction fronts are produced using the Ferroin-catalyzed Belousov-Zhabotinsky (BZ) chemical reaction. We use the experimental velocity field and a three-dimensional set of ODEs to predict from theory the location and orientation of BIMs. These predicted BIMs are found to match up well with the propagation barriers observed experimentally in the same flow using the BZ reaction. We explore the nature of BIMs as one-sided barriers, in contrast to invariant manifolds that act as barriers for passive transport in all directions. We also explore the role of projection singularities in the theory and how these singularities affect front behavior.

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