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The effects of chaotic mixing on patterns and fronts in an advection-reaction-diffusion system[1] TOM SOLOMON, JEFFREY BOEHMER, Bucknell University — We present experimental studies of the effects of fluid flows on reaction fronts and spatial patterns in the excitable Belousov-Zhabotinsky reaction. The flow is a square array of vortices, generated using magnetohydrodynamic techniques. Time-dependent forcing of the flow is achieved by displacing the fluid periodically in a circular manner relative to the vortex flow. Mixing of passive impurities in this flow is chaotic, with long- range transport that is typically diffusive (enhanced), although superdiffusion with Lévy flights is also possible. Reaction fronts in this flow show small-scale patterns that reflect the stable and unstable manifolds that characterize chaotic mixing in this flow. Even on a larger scale, front structure reflects the underlying anisotropy of the vortex lattice. In many cases, the front mode-locks to the external forcing, lining up with the vortex array in a self-correcting manner. Self-generating trigger waves are also found in this system, producing both spiral and target patterns similar to those found in reaction- diffusion systems.

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