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Synchronization via superdiffusive mixing in an extended, advection-reaction-diffusion system[1] MATT PAOLETTI[2], CAROLYN NUGENT, TOM SOLOMON, Bucknell University — We study synchronization of the Belousov-Zhabotinsky (BZ) chemical reaction in an annular chain of alternating vortices. The vortex chain can (a) oscillate, in which case chaotic advection enhances mixing between adjacent vortices, and/or (b) drift, in which case a jet region forms allowing tracers to travel rapidly around the annulus. If the chain both oscillates and drifts, the long-range transport is diffusive for drift velocity $v_d <$ oscillation velocity v_o and superdiffusive for $v_d > v_o$. We map out the regimes in parameter space (v_o versus v_d) where the BZ reaction synchronizes. We find that synchronization is much more prevalent for the regimes in which transport is superdiffusive. The results are interpreted by considering Levy flights – tracer trajectories characterized by long jumps – associated with superdiffusive transport as "short-cuts" connecting distant parts of the system, similar to those proposed for discrete "small world" networks.

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