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Chemical patterns in a two-dimensional vortex array with chaotic mixing[1] JEFF BOEHMER, TOM SOLOMON, Bucknell University — We present experimental studies of patterns formed by both the oscillatory and the excitable Belousov-Zhabotinsky (BZ) chemical reaction in a two-dimensional array of vortices. Two flows are used: a 14 x 14 array of 3/4" square vortices and a 40 x 40 array of 1/4" vortices. Two sets of plungers oscillate the fluid slowly back and forth across the system, resulting in chaotic mixing between the vortices. For both the excitable and oscillatory BZ reaction, chemical patterns form on small scales that mimic the stable and unstable manifolds that characterize chaotic mixing. On a larger scale, target and spiral patterns are observed, similar to those seen in the reaction-diffusion (no flow) limit. We explore the relation of these patterns to the size and strength of the vortices, as well as the frequency and amplitude of the oscillation of the vortex array. We also compare and contrast patterns formed by phase waves (oscillatory reaction) with those formed by trigger waves (excitable reaction).

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