The Department of Physics at Virginia Tech presents:

Friday, Feb. 15
@ 2:30 P.M. 210 Robeson

Pattern formation and front propagation in reacting systems with chaotic mixing

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We present experiments on the dynamics of the Belousov-Zhabotinsky (BZ) chemical reaction in vortex flows that exhibit chaotic mixing. The BZ reaction is well-known as an oscillatory reaction that can display chaotic time-dependence. In the absence of any fluid flow, the BZ system produces target and spiral patterns, similar to those found in a wide variety of reaction-diffusion systems in physics, biology and chemistry. We explore how these patterns are altered in the presence of a chain or array of oscillating and drifting vortices. Experiments show that the patterns that form mimick those associated with chaotic mixing in these flows. Furthermore, we find that if long-range chaotic mixing is superdiffusive with Levy flight trajectories, large-scale synchronization of the oscillating pattern is observed. Other experiments show that fronts propagating in an oscillating vortex flow mode-lock to the frequency of the oscillation. Cellular flows are also found to "freeze" the motion of an interface in the presence of an imposed "wind."