Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Front propagation in vortex-dominated flows[1] GARRETT O'MALLEY, JUSTIN WINOKUR[2], TOM SOLOMON, Bucknell University — We present experiments that explore how the propagation of a reaction front is affected by a two-dimensional flow dominated by vortices. The reaction is the excitable Belousov-Zhabotinsky chemical reaction. The flow is driven by the interaction between an electrical current passing through the fluid and a spatially-varying magnetic field produced by an array of magnets below the fluid. For some of the experiments, the forcing is strong enough to produce a weakly turbulent flow. Measurements are made both of the enhanced diffusion coefficient D^* describing transport in the flow and of the propagation speed v of a reaction front in the same flow. Scaling of v versus D^* is compared with that for the standard Fisher-Kolmogorov-Petrovsky-Piskunov prediction $v \sim \sqrt{D}$ (with D as the molecular diffusion coefficient) for the reaction-diffusion limit with no fluid advection. We also study the effects of superdiffusive transport and Lévy flights on front propagation in a time-dependent vortex array with wavy jet regions.

[1]Supported by NSF Grants DMR-0703635 and PHY-0552790.
[2]Current address: Dept. of Physics, Carnegie-Mellon University, Pittsburgh, PA

Thomas Solomon
Bucknell University

Date submitted: 01 Aug 2008 Electronic form version 1.4