Abstract Submitted
for the OSS19 Meeting of
The American Physical Society

Disruption and Recovery of Reaction-Diffusion Wavefronts Colliding with Obstacles[1] NIKLAS MANZ, REBECCA GLASER[2], NATHANIEL J. SMITH, VINCENT W.H. HUI, JOHN F. LINDNER, College of Wooster — We study the damage to and restoration of planar reaction-diffusion wavefronts colliding with convex obstacles in narrow two-dimensional channels using finite-difference numerical integration of the Tyson-Fife reduction of the Oregonator model of the Belousov-Zhabotinsky reaction. We characterize the obstacles' effects on the wavefront shape by plotting wavefront delay versus time. Due to the curvature dependent wavefront velocities, the initial planar wavefront (or iso-concentration line) is restored after a relaxation period that can be characterized by a power-law. We find that recovery times are insensitive to obstacle concatenation or to the upstream obstacle shape but are sensitive to the downstream shape, with a vertical back side causing the longest disruption. Delays vary cyclically with obstacle orientations. The relaxation power-laws confirm that larger obstacles produce larger wavefront delays and longer recovery times, and for a given area larger obstacle width-to-length ratios produce longer delays. Possible applications include elucidating the effect of inhomogeneities on wavefront recovery in cardiac tissue.

[1]This work is supported by the National Science Foundation [NSF-REU grant number DMR 1560093] and The College of Wooster
[2]Permanent address: SUNY Geneseo

Niklas Manz
College of Wooster

Date submitted: 10 Mar 2019 Electronic form version 1.4