Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Coupled Oscillations in a 1D Emulsion of Belousov-Zhabotinsky Droplets[1] SETH FRADEN, JORGE DELGADO, NING LI, MARCIN LEDA, HECTOR GONZALEZ-OCHOA, IRVING EPSTEIN, Brandeis University — We experimentally and computationally study the dynamics of interacting oscillating Belousov-Zhabotinsky (BZ) droplets of ∼120 μm diameter separated by perfluorinated oil and arranged in a one-dimensional array (1D). The coupling between BZ droplets is dominated by inhibition and is strongest at low concentrations of malonic acid (MA) and small droplet separations. A microfluidic chip is used for mixing the BZ reactants, forming monodisperse droplets by flow-focusing and directing them into a hydrophobized 100 μm diameter capillary. For samples composed of many drops and in the absence of well defined initial conditions, the anti-phase attractor, in which adjacent droplets oscillate 180° out of phase, is observed for strong coupling. When the coupling strength is reduced the initial transients in the phase difference between neighboring droplets persist until the BZ reactants are exhausted. In order to make quantitative comparison with theory, we use photosensitive $Ru(bipy)_3^{2+}$-catalyzed BZ droplets and set both boundary and initial conditions of arrays of small numbers of oscillating BZ droplets with a programmable illumination source. In these small collections of droplets, transient patterns decay rapidly and we observe several more complex attractors, including ones in which some adjacent droplets are in-phase.

[1]This work was supported by the National Science Foundation (CHE-0615507 and MRSEC DMR-0820492).

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Date submitted: 18 Nov 2010 Electronic form version 1.4