Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Period Doubling in Bubbling from a Submerged Nozzle[1] JORDAN DENNIS, LAURA GRACE, SUSAN LEHMAN, The College of Wooster — The timing of bubbles rising from a nozzle submerged in a viscous solution was measured to examine the period-doubling route to chaos in this system. A narrow nozzle was submerged in a mixture of water and glycerin, and nitrogen was supplied to the nozzle at a varying flow rate. The bubbles were detected using a laser and photodiode system; when the bubbles rise through the laser beam, they scatter the light so that the signal at the photodiode decreases. The period between bubbles as well as the duration of each bubble (a function of bubble size and bubble velocity) was determined, and examined as the nitrogen flow rate increased, for solutions with five different concentrations of glycerin. Bubbles were also recorded visually using a high-speed camera. Within the flow rates tested, we observed a bifurcation of the period to period-2 behavior for all solutions tested, and a further bifurcation to period-4 for all solutions except pure glycerin. The solution viscosity affected both the onset of the bifurcation and the precise bubble behavior during the bifurcation. Unusually, a short period/long period pair of bubbles recurring at a regular interval was sometimes observed in the low flow regime which is typically period-1, an observation which requires further investigation.

[1]Research supported by NSF DMR 1560093

Susan Lehman
The College of Wooster

Date submitted: 11 Nov 2016 Electronic form version 1.4