

Abstract Submitted  
for the DAMOP08 Meeting of  
The American Physical Society

**Chaotic Escape of Particles from a Vase-shaped Cavity: Theory and Experiment**<sup>1</sup> JAISON NOVICK, College of William and Mary, KEVIN MITCHELL, University of California, Merced, LEN KEELER, University of Minnesota, Morris, JOHN DELOS, College of William and Mary — We study the escape of particles from a two dimensional, specularly-reflecting open vase-shaped cavity. The narrowest point of the vase's neck defines a dividing surface between particles that escape without return and those turned back into the vase. We find trajectories whose path displays a sensitive dependence on launch angle. For our analysis, we consider a point burst of particles emitted in all directions and record the time to reach the vase's neck. We find that this escape time versus the launch angle displays a complex fractal structure. First, we outline a topological theory that predicts a subset of the fractals seen in numerical simulations. We perform a simulation of classical trajectories and compare the simulated fractal to the theoretical prediction. Through a collaborative effort we have experimentally verified the early fractal structure in the escape time using ultrasound. A microphone was placed along the vase's neck to record escaping pulses. We find that classical trajectories arriving at the microphone positions arrive very near the times at which the experimental signal is strongest.

<sup>1</sup>Supported by NSF

Jaison Novick  
College of William and Mary

Date submitted: 01 Feb 2008

Electronic form version 1.4