

# Chladni Plates and Cymatics

Gavin Costa, Aidan Ayer-Richardson, Department of Mathematics and Statistics, University of New Hampshire



University of  
New Hampshire

## Introduction

A Chladni plate can show how vibrations move through a solid surface. It consists of a metal plate and a sound source that drives the plate at specific frequencies. When the plate vibrates at one of its resonant frequencies, standing wave patterns form across its surface. These patterns include regions of maximum motion (antinodes) and no motion (nodal lines). Sand or other fine substances that are sprinkled on the plate is pushed away from the vibrating areas and collects along the nodal lines, visible and distinct patterns based on resonance frequencies. This phenomenon is an example of cymatics, the study of visible sound and vibration patterns. This project is aimed towards the creating of a Chladni plate and the study of these visible resonance patterns.

## Objectives

- Objective 1 – Fully design and assemble a working Chladni plate experiment from scratch
- Objective 2 – Learn about and work with the mathematics behind cymatics and Chladni plates
- Objective 3 – Relate these results to our experimental results and discuss relations to real life scenarios

## Methods

This Chladni plate experiment setup consists of a few main parts; an amplifier, a subwoofer, and a laptop. The amplifier acts as a bridge in the system, connecting the laptop and the battery to the subwoofer. The subwoofer part is comprised of the subwoofer and a couple of 3D printed parts, a housing for the subwoofer to sit it in to keep it off the ground and a small hollow dome, with a hole in the top to put a screw through used for holding the plates in place. The last piece was the laptop, which in our case is the tone generator. This seemed to be the simplest solution for frequencies on the go, as with the loud a possibly disruptive nature of this project, it was necessary to make the project easily portable.

## Results

The group struggled with a series of unfortunate events that prevented a working prototype to be finished in time for much testing to be completed, leading to limited results despite the fully working prototype. These issues mainly stemmed from a larger than expected academic workload, varied/conflicting schedules, delayed deliveries, and the third group member needing to leave towards near the end of the project. Despite these setbacks, the group conducted some small experiments with the final setup, shown on right:



## Conclusions

As shown in the images to the left, the building of the Chladni plate was a success, and given more time the team would have been able to collect data properly and complete the originally planned computations. Although not all of the group's objectives were completed, the portions they did complete were valuable learning experiences.

## Next Steps

- The group would love to continue this project either on their own or with a researcher
- With a working prototype, the next steps would involve testing and data collection
- There is a possibility of this project being continued either over the summer or during the sophomore year

## Acknowledgments

We would like to thank Professor John Gibson and his team in the Patterns and Symmetry Cohort, the Innovation Scholars Program, the UNH Makerspace, Wesley Burrow, and the College of Engineering and Physical Sciences.