

Student projects for PHY103 (2014)

The physics of/and music encompasses a wide range of topics, some that we will cover in labs and lectures in this class. However the diversity of subject matter related to this topic cannot be captured in a single semester course. Consequently an important part of this class is the opportunity to investigate a specific topic of your own interest. Because the students in this class have diverse interests, descriptions in class of student research projects at the end of the semester can be interesting. Often students choose to create build or modify musical instruments as part of their project. In 2011 the instruments were so interesting we had a short class concert. This year our concert will be in collaboration with the AME 196 showcase on Dec 10. You can choose to perform something on Dec 10 or describe your project on Dec 9. Some form of presentation (either classroom or performance) is a requirement of the final project.

What is required: A write up and one of the following: A classroom presentation or a short performance. Presentations can be done in collaboration but write-ups need to be done individually.

Due dates for Write-up: Thursday Dec 11 at midnight (usual place B+L403 mailbox).

Research Presentations: Last class Tuesday Dec 9 at 9:40am (classtime)

Performance showcase: in collaboration with AME 196 on Wednesday Dec 10 in Rettner Hall Atrium 12:30-2pm

What to turn in: 4-8 page description of your research project. Written in the same way as your lab reports with an **abstract** summarizing your project and results. The analysis section should support your major findings that are listed in the abstract. Your conclusion can discuss future work or connections to other fields. This year we have not required description of procedures or experiments in the lab reports, however as you are designing your own experiments, and we aren't going to know how you did them, you will need to describe your procedures as well as your analysis in your project report.

What to present: Either present a short (10 minute) description of your research and your results on Dec 9 in class **or** a short (few minute) musical performance at the showcase. If you chose a musical performance it should be related to your research project (illustrating a new or modified musical instrument or musical creation). If you have a conflict on Dec 9 we will arrange another time for a class or lab presentation. We can't change the concert date so if you have a conflict on Dec 10 please chose to present in class on Dec 9 instead.

As soon as the 10 planned labs are finished, the lab will be open during lab times for you to work on your projects and the TIs and professor there to discuss project ideas and help you out. We can also open the lab for you to work at other times (drop by my office or arrange a time to be let in by either professor or TI). Materials, tools and the computers in the lab can be used to work on projects. Ask us if you need help obtaining additional equipment or want to find out if you can find/borrow/use other items that you can't find

in the lab. The requirements listed below are intended to enrich your project by encouraging you to find information related to your topic and encouraging numerical or quantitative exploration and experimentation, similar to our lab activities --- but on a topic of your choice. A quantitative or experimental focus is important for this project.

In the past few years some really interesting projects have been carried out by students this class. Of the most memorable: a musical composition for whales, a glass xylophone with a really unique sound, 3 drums made from coffee cans showing the effect of the air column on timber, harmonic and streaming analysis of the same duet played by different pairs of instruments, interviews of 400+ people in a crowded airport on what influences music listening choices, review of computational algorithms for music genre recognition, study of bell timbre as a function of angle, influence of tuning on timbre in baroque violins, how angle and distance from instrument affects timbre in a harp, a failed attempt to modify a clarinet with a gourd, experiments with creating reads from plastic and metal sheets, the history of Wilson commons and some discussion on why it is acoustically awful, sound tests in Eastman-Kodak Hall prior to renovation, and a spectacular performance of interesting built instruments in Goergen Hall Atrium in 2011 (a video on You-tube) just to name a few. If you design and build an instrument, you could take data and explore its acoustics or explore variations on design and aspects of redesign.

Additional requirements for the write up:

- 1) Must refer to at least one recent (last 20 years) publication in a modern research journal. This paper should be relevant to your topic and enrich your study or exploration. It should not be a general paper for a non-scientific or children's audience. It could be a chapter of a science or engineering book that helped you learn about and understand your topic. Please include a complete citation to your article, including author names, journal title, article title, date of publication ...

AND

- 2) Must have at least one of the following:
 - a) Presentation and analysis of experimental data that you took
 - b) Quantitative estimates
 - c) Description of design modifications and how they worked

I realize that not all projects lead to being enriched with satisfying these requirements and we can make exceptions. For example one previous project that reviewed genre recognition software was excellent. This project included citations to a dozen or more research and engineering papers but lacked experimental data, numerical estimates or equations. The project did discuss software tests and success fractions and so did include discussion of quantitative measurements.

Collaboration policy: You can collaborate (that means help each other out). For example, students could collaborate on doing experimental measurements or building an instrument or in performance. However each student must take the lead and write up a **unique** piece of work. If you form a group then each person in the group must have a specific part of the project that they are responsible for. Presentations/performance can

be done as a collaborative group. If you chose to perform then you should also arrange to attend a rehearsal. Since our concert is in collaboration with AME 196 we will need to coordinate with their rehearsals.