DEGREE/PROGRAM CHANGE
FORM C
Form Number: C1778

Fields marked with * are required

Name of Initiator: Patricia Henning **Email:** henning@unm.edu **Phone Number:** 505 277-3166 **Date:** 10-30-2015

Associated Forms exist? No Initiator's Title Professor: Physics Astronomy Department

Faculty Contact Patricia Henning Administrative Contact Lina Sandve

Department Physics and Astronomy Admin Email lsandve@unm.edu

Branch Main Campus Admin Phone 277-1516

Proposed effective term

Semester Spring Year 2016

Course Information

Select Appropriate Program Undergraduate Degree Program

Name of New or Existing Program PHYC 108 & 108L for UNM Core

Select Category UG Core Course Degree Type

Select Action New

Exact Title and Requirements as they should appear in the catalog. If there is a change, upload current and proposed requirements.
See current catalog for format within the respective college (upload a doc/pdf file)

Henning syllabus p108 2016.pdf

☐ **Does this change affect other departmental program/branch campuses? If yes, indicate below.**

Reason(s) for Request (enter text below or upload a doc/pdf file)
Add existing courses PHYC 108 and 108L to the Undergraduate Core.

Upload a document that inlcudes justification for the program, impact on long-range planning, detailed budget analysis and faculty workload implications.(upload a doc/pdf file)

PHYC 108 and 108L in Core.pdf

☐ **Are you proposing a new undergraduate degree or new undergraduate certificate? If yes, upload the following documents.**

Upload a two-page Executive Summary authorized by Associate Provost. (upload a doc/pdf file)

Upload memo from Associate Provost authorizing go-ahead to full proposal. (upload a doc/pdf file)

PHYSICS 108

MUSICAL ACOUSTICS

Spring 2016

Instructor: Prof. Patricia (Trish) Henning

Class Time: Tuesdays and Thursdays 11:00 – 12:15

Location: 103 Regener Hall

Office Hours: Tuesdays and Thursdays after class, in Regener Hall. Other times by appointment.

email: henning@phys.unm.edu

Office: Room 1165, Physics and Astronomy Bldg.
(corner of Lomas and Yale; see map at the end of this syllabus).

Text: Why You Hear What You Hear, Eric J. Heller, Princeton University Press (required). The book has a great website www.whyyouhearwhatyouhear.com, and links to other good material, especially Dan Russell's acoustics animations website www.acs.psu.edu/drussell/demos.html.

Course Philosophy: Some people are scared off by physics these days, which is a real shame, because physics is really just thinking about how things work. In this class, we'll look at sound production and propagation (how it travels), with emphasis on music and musical instruments, the human voice and hearing, and acoustics of spaces where sound is made. Topics will include: general properties of sound, applications to musical instruments, the human ear, the human voice, room acoustics, harmonics, tone quality, pitch, and musical scales.

There will be some lecturing and lecture demonstrations, computer simulations, small group hands-on activities, and class discussions. We will also have three special classes, with guest speakers and instrumentalists from other departments on campus. One will happen in our usual classroom, the topic will be Tuning and Temperament. Another will be a visit to the violin construction workshop on campus. The third will be held at St. John's Episcopal Cathedral downtown, to see and hear the amazing organ, the largest in the state of New Mexico. During class time, we will focus on concepts, and making sure we all understanding them. Reading the textbook is important for understanding the material, and I will let you know what to read as we go along (the textbook is required). Also, homework will help you to understand the material, and will give you practice with the most important concepts.

A proposal to add PHYC 108: Musical Acoustics, and PHYC 108L: Musical Acoustics lab, to the existing Core Curriculum

Identification of the area into which the course will fit: **Physical and Natural Sciences**

Contained in this document:

I. Rationale for adding the course to the Core

- Justification for adding the course to the Core
- How will this course benefit UNM students?
- Why does it belong in the UNM Core Curriculum?
- Impact statement on the effect this addition may have upon other departments/courses currently in the Core
- Current and predicted enrollments for the next three years
- Example of "Annual Report on Assessment"

II. Budget/Faculty load statement

- Budget impact statement
- Resources (faculty/facilities) that the department has for teaching the course

III. Documentation of UNM and HED Core Competencies addressed and Student Learning Outcomes and proposed techniques to assess those outcomes

IV. Complete syllabus and course schedule including time on topics and suggested text

I. Rationale for adding the course to the Core

Arguments for including PHYC 108 and 108L in the UNM Core

PHYC 108, and the accompanying lab 108L, are courses meant for non-science majors who wish to gain a deeper understanding of sound. There are no prerequisites, so we welcome students from all backgrounds to the class. Through the study of sound, we introduce students to the broader idea of waves and vibrations in nature, which are fundamental to understanding what we see and hear in the physical world. The focus is on sound and its production, but ideas are introduced which range from the nature of light as a wave, to sound waves in the early Universe.

We believe it is of fundamental importance that non-scientists have an understanding that the physical world is relevant to them, and that it is something comprehensible. Students learn about, and conduct, measurements and experiments to learn about vibrating systems, both in lab and in hands-on activities in lecture. They learn to predict, and check their ideas, which will benefit UNM students in any field. We teach a scientific way to observe and query, via study of an inherently interesting topic, sound and music. We do hands-on activities in lecture, but it is in the lab where students have more time to properly experiment to gain a deeper, practical understanding of waves. We are not trying to make physicists out of all of the students, but rather introduce a physical way of thinking about how things work in the world. Having this course in the Core will be especially useful to students who major in Music Education and in Speech and Hearing Sciences, as these majors require or recommend their students take PHYC 108 and the lab. Introducing the courses to the Core will help these students move efficiently through their majors and other UNM requirements, to streamline the path to graduation. There is always a broad range of students represented in PHYC 108, from Engineering to Philosophy and English. Architecture students who need to understand seismic waves and acoustic design would be another audience who would benefit from a broad understanding of waves.

It is not likely that PHYC 108 will have a large impact on enrollments of other core courses. The largest impact may be on PHYC 102, Introduction to Physics, and PHYC 105, Physics in Society, which are the other PHYC “10X” courses, attracting students who are already pre-disposed to take a physics course. However, these two courses have quite different flavors, one being a survey course with shallow coverage of many topics, the other being the Physics in Society

course, with economic and political implications, and thus likely a different student population.

Current and predicted enrollment:

The following table shows enrollment figures for PHYC 108 and PHYC 108L for the past five years:

Semester	PHYC 108	PHYC 108L
Spring 2015	**27**	**13**
Spring 2014	**33**	**4**
Spring 2013	**71**	**26**
Spring 2012	**60**	**19**
Spring 2011	**57**	**24**

There has been some variation of the numbers over this period, though even if the enrollment were to triple as the class becomes part of the Core (which we would not expect), we have capacity to teach the additional students with modest new resources required.

Example of "Annual Report on Assessment"

Assessment reports will be compiled when the course enters the Core, and will consists of embedded questions in in-class exams in PHYC 108. All students who take the lab also take the lecture, so this will capture those students as well. Details on questions related to Course Goals are included in Section III of this proposal.

II. Budget/Faculty load statement

A. Budget impact statement: One section of PHYC 108 has been taught in the spring semester for many years. We teach one or two sections of the lab, depending on enrollment. Enrollments in the lecture have varied between 30 – 70 in recent years, with the majority of the students coming from the Music, and

Speech and Hearing Sciences departments. We anticipate the enrollment would increase as this course is added to the Core, but the capacity of the Physics lecture hall, which has the needed demonstrations and acoustical equipment, is 300, so we do not expect to add any new sections, thus no increase in cost to the department or university. Each section of laboratory can accept up to 24 students, so we will likely not have to expand beyond two sections, however we can add more sections with little impact, as the equipment, and lab supervisor, are already in place.

B. Resources (faculty/facilities) that the department has for teaching the course: We teach the lecture course in Regener Hall room 103 which is equipped with demonstrations, including audio equipment for the lecture, and hands-on activities in class. Wireless is available for online demonstrations and activities. In recent years, since 2008, the course has been taught by two Physics and Astronomy faculty members. Before that, it was taught by a lecturer. There is now continuity of instructor, and its introduction into the Core, and attendant assessment, will be overseen by an experienced instructor (Henning). The lab will continue to be overseen by Principal Lecturer Odom, with TAs trained by him. There is no increase in resources, other than a possible addition of a lab section, taught as part of a TA load. If we add a new section of lab, that would require 1/3 of a TA. The lab room is equipped for each section of lab, a new section will not imply new equipment is needed.

III. Documentation of UNM and HED Core Competencies addressed and Student Learning Outcomes and proposed techniques to assess those outcomes

PHYC 108: Course Goals, Student Learning Outcomes, and Assessment

Course Goals

1. Students will recognize and be able to describe wave and vibrational phenomena, understanding that waves and vibrations are all around them in the physical world.

2. Students will relate human perception of sound to its production, and propagation through space.

3. Students will gain competency in interpreting graphs, and basic quantitative problem solving skills.

4. Students will develop a general understanding of the logical and quantitative analyses that scientists use to study phenomena and processes.

The success in meeting these goals will be assessed by the following outcomes. The outcomes were chosen to cover some of the most important topics and to demonstrate a range of skills in critical thinking and solving problems, not necessarily to cover all the topics in the course.

Outcomes:

Outcome 1: Students will demonstrate understanding of the basic properties of waves, including wavelength, frequency, and velocity. They will answer qualitative questions on the relationship between frequency, wavelength, and velocity, and quantitative problems involving simple calculations and interpreting graphs regarding waves.

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, Apply quantitative analysis to scientific problems, and Apply scientific thinking to real world problems.

Outcome 2: Students will demonstrate understanding of wave reflection, diffraction, and interference, through graphical representation, and quantitative problems.

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, Apply quantitative analysis to scientific problems, and Apply scientific thinking to real world problems.

Outcome 3: Students will demonstrate understanding of the relationship between intensity of sound, and the human perception of loudness. This is shown through qualitative, quantitative, and graphical questions. They will understand the relationship between frequency and pitch.

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, Apply quantitative analysis to scientific problems, and Apply scientific thinking to real world problems.

Outcome 4: Students will demonstrate recognition of vibrational modes in a variety of instruments, and the relationship to frequencies produced, and how humans can control these modes and thus the timbre of sound.

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, Apply quantitative analysis to scientific problems, and Apply scientific thinking to real world problems.

Outcome 5: Students will demonstrate understanding, from a basic physical standpoint, of how sound energy is translated to perceived sound by the human ear/brain system.

NM HED Area III competencies 2, 4 and 5: Solve problems scientifically, Apply quantitative analysis to scientific problems, and Apply scientific thinking to real world problems.

Assessment Data Collection:

For each outcome the material will be covered in class using teaching strategies that include lecture, demonstrations, example problems, and hands-on activities with worksheets. Homework will include problems that require these outcomes skills. Assessment will come from embedded questions in exams.

Rubric:

Evaluation: For each SLO, there will typically be either three or more questions covering the concept. The SLO can be assessed with either of two methods. Method 1 assesses students' performance based on the percentage of questions they answered correctly in each rubric as a group. The instructor can then examine the percentage of students demonstrating Exemplary, Satisfactory, or Unsatisfactory performance on each SLO. Method 2 is more simply based on the average score of all students on all questions in each rubric. The instructor can use this average score to decide if the class performance as a whole is Exemplary, Satisfactory, or Unsatisfactory. The table below provides more detail on what is meant by Exemplary, Satisfactory, or Unsatisfactory performance on each SLO.

Exemplary	Satisfactory	Unsatisfactory
Method 1: a student correctly solves or answers all three problems or qualitative questions, (or at least 75% if more than 3 problems/questions). Method 2: the average score of students on the problems and questions is at least 75%.	Method 1: a student correctly solves at least 50% of the problems, or answers qualitative questions. Method 2: the average score of students on the problems/questions is 50-75%	Method 1: a student solves 50% or less of the problems or answers 50% or less of the qualitative questions correctly. Method 2: the average score of students on the problems/questions is less than 50%.

Finally, it is worth noting that PHYC 108 and 108L have direct relevance to at least three of the "LEAP" standards:

The Association of American Colleges and Universities' LEAP Outcomes are 1) Knowledge of Human Cultures and the Physical and Natural World; 2) Intellectual and Practical Skills; 3) Personal and Social Responsibility; and, 4) Integrative Learning.

The courses directly address 1, 2, and 4, and arguably 3, via the students' working together in workgroups in lecture and in lab.

IV Sample Syllabus and Schedule

PHYSICS 108

MUSICAL ACOUSTICS

Spring 2015

Instructor: Prof. Patricia (Trish) Henning

Class Time: Tuesdays and Thursdays 11:00 – 12:15

Location: 103 Regener Hall

Office Hours: Tuesdays and Thursdays after class, in Regener Hall. Other times by appointment.

email: henning@phys.unm.edu

Office: Room 1165, Physics and Astronomy Bldg.
(corner of Lomas and Yale; see map at the end of this syllabus).

Text: Why You Hear What You Hear, Eric J. Heller, Princeton University Press (required). The book has a great website www.whyyouhearwhatyouhear.com, and links to other good material, especially Dan Russell's acoustics animations website www.acs.psu.edu/drussell/demos.html.

Course Philosophy: Some people are scared off by physics these days, which is a real shame, because physics is really just thinking about how things work. In this class, we'll look at sound production and propagation (how it travels), with emphasis on music and musical instruments, the human voice and hearing, and acoustics of spaces where sound is made. Topics will include: general properties of sound, applications to musical instruments, the human ear, the human voice, room acoustics, harmonics, tone quality, pitch, and musical scales.

There will be some lecturing and lecture demonstrations, computer simulations, small group hands-on activities, and class discussions. We will also have three special classes, with guest speakers and instrumentalists from other departments on campus. One will happen in our usual classroom, the topic will be Tuning and Temperament. Another will be a visit to the violin construction workshop on campus. The third will be held at St. John's Episcopal Cathedral downtown, to see and hear the amazing organ, the largest in the state of New Mexico. During class time, we will focus on concepts, and making sure we all understanding them. Reading the textbook is important for understanding the material, and I will let you know what to read as we go along (the textbook is required). Also, homework will help you to understand the material, and will give you practice with the most important concepts.

The Lab (P108L): There is a lab which goes along with this course, and although it is not required for the class, I do suggest you take it if you can. The lab meets Thursday afternoon, 1:00 – 2:50. The lab gives you an opportunity to spend time exploring some of the major concepts in depth, and will solidify your understanding. Again, the lab is not required for the class, you can take the lecture alone if you want, but some majors do require it – so be aware of that in your particular case.

Extra Help: I know it can be intimidating to speak in class, but if you don't understand something, please stop me and ask! Chances are people around you don't understand it either. Come to office hours or send an email if you prefer. Feel free to come to office hours if you want to chat about any acoustics-related topic. Also, there is CAPS (Center for Academic Program Support), and you're encouraged to use that resource, especially for the physics we'll talk about. CAPS tutors don't necessarily have much experience specifically with musical

acoustics, so always feel free to come to me with any questions you might have. Experience shows that students who come to me with questions about homework – before the homework is due – are always glad that they did! If you are busy during my office hours, just make an appointment, we can find another mutually agreeable time.

A Word About Prerequisites: There are no UNM prerequisites for this class, and I do realize that the vast majority of you are not science majors (though if you are interested in majoring in physics and astronomy, come talk to me!). One of the great things about this class is that students come from different backgrounds, many from the fine arts and the humanities. The class will be as non-mathematical as possible, but we do need to use some math to understand the concepts. So, math skills as required for admission to the University are assumed, and this level of math will be used in the homeworks and the exams. This includes reading graphs, and early algebra skills. We'll talk about logarithms in class as needed for decibels. You should bring your calculator to class, to use during the in-class activities. This is a great opportunity to refresh or augment your skills in a non-threatening (I hope) environment. Please come talk to me if you have concerns. Use your resources: office hours, CAPS, and fellow students are great places to get support as needed.

COURSE GROUND RULES AND GRADING

Reading. The lectures and demos will be designed on the assumption that you've read the supporting reading in the text before class. I'll let you know what to read as we go along.

Homework. I will assign homework in class, and all together the homework counts 25% of the grade. Homework will be collected at the beginning of class, on the day it's due. I encourage you to form study groups with classmates, and you certainly may work together on homework, but each person must hand in his/her own homework to get credit. Identical homeworks will earn zeroes. You need to hand in the homework on time to keep up in the class. To encourage this, I will give only half-credit for late homework handed in by the lecture after the due-date, and no credit after that. Please don't email me your homework, you need to hand it in at the beginning of class, on the day it's due.

Exams. Your progress will be assessed by three exams, each counting 25% of the grade. You will be allowed to bring one 3" x 5" note card to each exam, which I'll collect at the end of the exam (but they're not graded). I will give you a blank card a few days before each test. The tests are closed notes and closed book.

Tentative schedule for exams: Thursday, 12 February, Thursday, 26 March and Tuesday, 5 May, (at 12:30 PM for this last one - we'll use our slot in the UNM final exam schedule, but it won't be a cumulative final). Put these important dates into your calendar now. I will announce any changes.

Regarding grade disputes; if you feel your test grade is in error, please bring it to my attention no later than 1 week after receiving your graded test.

Make-up tests. You may make up a test only if you have a valid excuse, which includes UNM activities (eg. concerts or athletic events, with official note from the Music or Athletic department), or illness with doctor's note, AND YOU NOTIFY ME BEFORE THE TEST. All make-ups will include an oral test. These take place IN MY OFFICE, not in Regener (see map at the end of the syllabus).

The Optional Project: If you like, you may do a project on some aspect of acoustics which interests you. As incentive, if you do a project, I will take the grade on your project and replace your lowest exam grade with it. You must still take all of the exams! This will not replace the homework grade. The idea of the project is for you to do original work, looking into some concept that interests you, in more depth than we have time for in class. For the project, you need to write up a half-to-one-page proposal, and hand it in no later than Thursday, 5 March, so I can approve the project and give you feedback before you write it up. Also, some projects involve a presentation in class. Regardless of whether or not you do a presentation, all projects must contain written work, to be handed in on Tuesday, 21 April. Class presentations will be during the last week of classes. I hope you will consider an optional project, we have had some really creative projects in the past, and the presentations have been a lot of fun.

Here are the options for the project:

Option 1: A 6-8 page typed paper on some aspect of acoustics of interest to you. Figures are encouraged. This should be based on at least 4 sources of information, at least two of which are beyond the textbook/website and my lectures. This can be related to your field or a hobby, but must contain physical acoustics concepts. Be careful not to plagiarize any of your sources. Wikipedia does NOT count as one of the sources, although it might be a useful place to start your research, and find resources.

Option 2: A 4-6 page report (including figures) on a hands-on acoustics project of your choosing, going beyond information in the textbook. In past years, students have done projects and presentations on electronic music, instrumental acoustics (even building their own instruments out of things from hardware stores!), microphones, concert hall acoustics, and many others. You can come up with your own idea, don't feel limited to these examples. We have had a lot of fun with this in the past, I hope you will let your creative side show! I especially encourage short presentations in class on these hands-on projects.

You do not have to do an optional project, but if you think you might want to, feel free to come talk to me about it at any time. All projects must be pre-approved. Again, the proposal deadline is Thursday, 5 March, and the written part is due Tuesday, 21 April, and the oral presentations will be during the last week of classes (exact date TBD).

Summary Time on Topics:

Week 1 Introduction to Waves (Wavelength, Frequency, Velocity)

Week 2 Pressure, Wave Interactions (Reflection, Diffraction, Interference)

Week 3 Focus on Wave Interaction with Obstacles: Room Acoustics

Week 4 Intensity, with special look at Decibels

Week 5 Simple Harmonic Motion, the Sine Function

Week 6 Complex Waves, The Study of Power Spectra

Week 7 The Harmonic Series

Week 8 The Perception of Pitch, Tuning and Temperament

Week 9 The Ear, and Perception of Loudness and Pitch Together

Week 10 Ideal String Vibration, the Harmonic Series, Violin

Week 11 Percussion and the (lack of) Harmonic Series

Week 12 Pitched Percussion – Manipulation of Vibrational Modes

Week 13 Air Column Vibrations, Reeds, Woodwinds

Week 14 The Organ, and Special Trip to Experience New Mexico's Largest Pipe Organ

Week 15 The Voice as an Instrument, Presentation of Optional Student Projects

Week 16 Review and wrap-up

PHYC 108L Schedule Spring 2015

Jan 15	Introduction
Jan 22	Galileo & Pendulum
Jan 29	Speed of Sound
Feb 5	Lab Cancelled

Feb 12	What You Hear
Feb 19	Interference
Feb 26	String Waves
Mar 5	Air Waves
Mar 12	SPRING BREAK
Mar 19	Sound Spectrum
Mar 26	Natural Frequencies
Apr 2	Wave Shapes
Apr 9	Modes, PROJECT
Apr 16	PROJECT
Apr 23	PROJECT

Course Objectives and Student Learning Outcomes:

By the end of this course, here are goals you should achieve:

- You will recognize and be able to describe wave and vibrational phenomena, understanding that waves and vibrations are all around you in the physical world.
- You will relate human perception of sound to its production, and propagation through space.
- You will gain competency in interpreting graphs, and basic quantitative problem solving skills.
- You will develop a general understanding of the logical and quantitative analyses that scientists use to study phenomena and processes.

Specifically, here are some of the skills and understanding you will attain by the end of the class:

- You will demonstrate understanding of the basic properties of waves, including wavelength, frequency, and velocity. You will be able to answer qualitative questions on the relationship between frequency, wavelength, and velocity, and quantitative problems involving simple calculations and interpreting graphs regarding waves.
- You will demonstrate understanding of wave reflection, diffraction, and interference, through graphical representation, and quantitative problems.
- You will demonstrate understanding of the relationship between intensity of sound, and the human perception of loudness. This is shown through qualitative, quantitative, and graphical questions. You will understand the relationship between frequency and pitch.
- You will demonstrate recognition of vibrational modes in a variety of instruments, and the relationship to frequencies produced, and how humans can control these modes and thus the timbre of sound.
- You will demonstrate understanding, from a basic physical standpoint, of how sound energy is translated to perceived sound by the human ear/brain system.

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Extra Help: I know it can be intimidating to speak in class, but if you don't understand something, please stop me and ask! Chances are people around you don't understand it either. Come to office hours or send an email if you prefer. Feel free to come to office hours if you want to chat about any acoustics-related topic. Also, there is CAPS (Center for Academic Program Support), and you're encouraged to use that resource, especially for the physics we'll talk about. CAPS tutors don't necessarily have much experience specifically with musical acoustics, so always feel free to come to me with any questions you might have. Experience shows that students who come to me with questions about homework – before the homework is due – are always glad that they did! If you are busy during my office hours, just make an appointment, we can find another mutually agreeable time.

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Accommodation Statement: Accessibility Services (Mesa Vista Hall 2021, 277-3506) provides academic support to students who have disabilities. If you think you need alternative accessible formats for undertaking and completing coursework, you should contact this service right away to assure your needs are met in a timely manner. If you need local assistance in contacting Accessibility Services, see the Bachelor and Graduate Programs office.

Academic Integrity: The University of New Mexico believes that academic honesty is a foundation principle for personal and academic development. All University policies regarding academic honesty apply to this course. Academic dishonesty includes, but is not limited to, cheating or copying, plagiarism (claiming credit for the words or works of another from any type of source such as print, Internet or electronic database, or failing to cite the source), fabricating information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students. The University's full statement on academic honesty and the consequences for failure to comply is available in the college catalog and in the Pathfinder.

COURSE GROUND RULES AND GRADING

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Homework. I will assign homework in class, and all together the homework counts 25% of the grade. Homework will be collected at the beginning of class, on the day it's due. I encourage you to form study groups with classmates, and you certainly may work together on homework, but each person must hand in his/her own homework to get credit. Identical homeworks will earn zeroes. You need to hand in the homework on time to keep up in the class. To encourage this, I will give only half-credit for late homework handed in by the lecture after the due-date, and no credit after that. Please don't email me your homework, you need to hand it in at the beginning of class, on the day it's due.

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Regarding grade disputes; if you feel your test grade is in error, please bring it to my attention no later than 1 week after receiving your graded test.

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The Optional Project: If you like, you may do a project on some aspect of acoustics which interests you. As incentive, if you receive a passing grade on the project, I'll bump up your final course grade one level. In other words, if you have a B, it would become a B+, or an A- would become A, and so on. The idea of the project is for you to do original work, looking into some concept that interests you, in more depth than we have time for in class. For the project, you need to write up a half-to-one-page proposal, and hand it in no later than Tuesday, 22 March, so I can approve the project and give you feedback before you write it up. Also, some projects involve a presentation in class. Regardless of whether or not you do a presentation, all projects must contain written work, to be handed in on Tuesday, 26 April. Class presentations will be during the last week of classes. I hope you will consider an optional project, we have had some really creative projects in the past, and the presentations have been a lot of fun.

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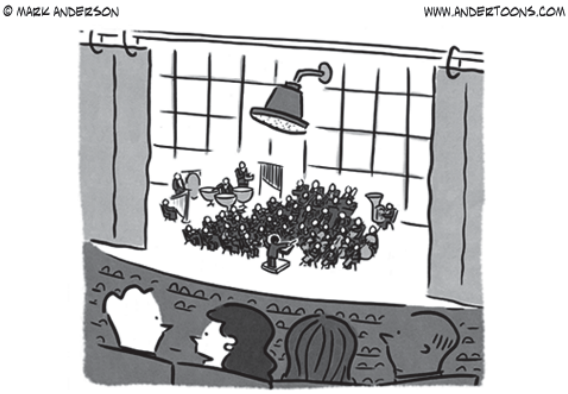
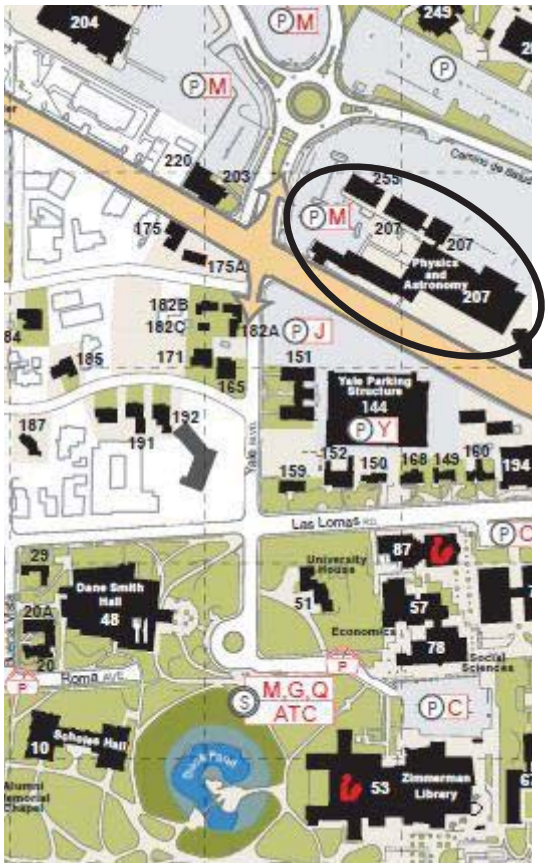
Option 2: A 4-6 page report (including figures) on a hands-on acoustics project of your choosing, going beyond information in the textbook. In past years, students have done projects and presentations on electronic music, instrumental acoustics (even building their own instruments out of things from hardware stores!), microphones, and many others. One idea, which no one has yet done, is to attend musical performances, or spoken word, in three venues, and to analyze the acoustics in these spaces using the ideas we will develop in class. You can come up with your own idea, don't feel limited to these examples. We have had a lot of fun with this in the past, I hope you will let your creative side show! I especially encourage short presentations in class on these hands-on projects.

You do not have to do an optional project, but if you think you might want to, feel free to come talk to me about it at any time. All projects must be pre-approved. Again, the proposal deadline is Tuesday, 22 March, and the written part is due Tuesday, 26 April, and the oral presentations will be during the last week of classes (exact date TBD).





Dr. Henning's office hours are in Regener Hall (where the lecture is) but her "regular" office is in the Physics and Astronomy building, shown here.