Musical acoustics is a unique area of study where art and science meet, providing a natural venue for learning about and appreciating science. This course will explore the generation and propagation of sound and your ear's response to it. We will study sound generated from a variety of musical instruments and by the human voice. There will also be an introduction to room acoustics, electronic synthesis, and digital sound. Our goals include: 1) learning the basic aspects of musical acoustics, 2) using physical concepts as tools to understand how sound and music works, 3) motivating and deepening your appreciation of scientific methods while building on your interest and understanding of sound and music, and 4) to have fun learning this!


Prereq.'s: No special background in physics or music is required. Basic math and logical thinking skills, enthusiasm, curiosity, and an open mind will be essential!

Reading is a critical part of 1240. Reading the text (and articles) before class is very important. Class time is to clarify your understanding, to help you make sense of the material that you have already started thinking about outside of class. I will assume you have done the readings in advance! Reading assignments will appear every lecture. (Extra readings, beyond the text, may be assigned from time to time.)

Class participation is another essential part of the course! This class is intended to be engaging and supportive. Don't try to "hide" in the back! Plan on attending and participating every day.

Homework will be assigned every week. There are TWO different kinds of homeworks(!) One is due on Fridays, (CAPA). The other ("online participation") is due Tuesdays, described below. CAPA (computer assisted physics assignments) is an automated grading system, used for calculations, some multiple choice/conceptual questions, and some long answers: all at www.Colorado.EDU/physics/CAPA/Cindex.html. The "long answer" requires writing - these are turned in through the CAPA system too. I'm afraid late HW of either kind cannot be accepted. (However, I will drop one homework of each type!) CAPA will allow you up until midnight on Friday to turn it in (after that, you're locked out!) For CAPA problems, you should work out the answers before you log on via the web to "hand it in". Each CAPA set is personalized (same problems, different numbers or details). You need a "pin" to sign on (different each week!), but you can have the system email this pin to you (go to the CAPA login page, there's a link there). Or, just pick up your personal hard copy in the basement. Some advantages to CAPA: you will have instant feedback on how well you are doing, and will have opportunities to change wrong answers without penalty at any point up to the deadline (as long as you haven't gone over a maximum number of tries on any given problem, usually a half dozen.) The "long answer" entry system is very crude, I recommend you write out your solutions elsewhere, and copy and paste into the CAPA form. The system will lose any pretty formatting - do NOT try to include "formula code" or figures, no attachments - just type in plain old text. (From time to time I may have you turn in a problem hardcopy in lecture on Thursday.) At the moment, you are limited to 2000 characters (about 300 words), so keep it brief and to the point. We aren't expecting massive essays, just clear writing that helps us see what you're thinking.

Online/preclass participation: Every Tuesday before class (deadline: 12 noon!!) you will need to complete a brief survey online. I will ask you to come up with at least one question you have about the reading. (That's what get graded) Additional questions may be about upcoming material which you aren't expected to know yet - it's a pretest to help me target lectures more effectively, or learn more about the class and how it's working. Unlike Friday homeworks, full credit is given simply for effort here, so please just be honest!

We encourage collaborative teamwork on homework, an essential skill in science (and highly valued by employers!) Collaboration is critical to anyone's success - most good ideas grow out of discussions with colleagues. As you study together, try to help your partners get over confusions, ask each other questions, critique each others homework. Teach each other. You will learn a lot! Note: While collaboration is the rule in any technical work, evaluations of individuals also play an important role. Exams will be done without help from others. For all assignments, the work you turn in must in the end be your own: in your own words, reflecting your own understanding. Plagiarizing classmates or other sources (e.g. web pages) without giving proper credit is grounds for failing an assignment. It's fine to talk with each other about how to do CAPA problems, but if this means giving (using) a formula they (you) don't really understand just to punch numbers into, to get credit - that's crossed a line... Copying long answer questions (or pieces of them, or slightly rewriting them) is outright plagiarism, please don't go there! Feel free to talk with me at any time if you are unsure of what this means, or if it applies in any given specific case!
Grading: I set an absolute scale for guidance (see the web for details) This may be curved down (i.e. in your favor!) if appropriate. But I promise never to curve up past that. So, if you get above 90% in the course, you're guaranteed an A (or actually an A-) in the course. (I'll be delighted if everyone earned an A, it's certainly possible!) The overall course grade weighting will be as follows: (See web for finer details)

- **45%** (total) for three exams (2 midterms and a final, weighted equally).
- **40%** for homework (total, split appropriately between long answer and CAPA) I drop 1 CAPA automatically!
- **10%** for weekly online participation (See above - this is graded on effort, not "correctness". Again, I'll drop one week!)
- **5%** for in-class participation (clickers are used for this) It's not about getting the questions right, just participation. I will automatically excuse up to three full days worth of absences. (You don't have to ask, this happens automatically)

**The right answers to clicker questions** are pure extra credit: they can reduce the total exam weight by up to 12% of the exam total (i.e. up to just over 5% of your total grade!) See web for details. The extra credit does not make up for missed homework, it simply reduces the pressure of exams. It's truly extra credit - getting clicker questions wrong never penalizes your grade.

Exams are scheduled (in-class) **Thurs Feb 15** and **Thurs Mar 22**. The final is **Tues May 8, 4:30-7 PM**. (If you have three finals on Tues May 8 and this one is your third, and you want to reschedule, this must be arranged with Prof. Pollock before Sep 30.) Be sure to be in class on exam days! *It is your responsibility to make sure you have no conflicts, there is no mechanism for making up exams. If you do miss one for valid reasons (generally medical) completely beyond your control, let me know immediately (in advance if possible) and provide me with documentation (e.g. a note from your physician) and I will drop that exam, using your average from the other two instead. For the rest - (homeworks and participation), unlike exams, your reason might be as simple as "I forgot", or "I was busy". For these, there is no need to inform me(!) I'll drop one each of those automatically, as described above.

Exams will be open book, based on reading and homework, as well as any material presented in lectures. **Students with disabilities, including non-visible disabilities, must let me know early (1st two weeks, in writing) so that your academic needs may be appropriately met. Please talk to Disability Services Office, Willard 322, 492-8671**

Deadlines: There is simply no mechanism to turn in late homework or online participation (I post solutions, and the systems shut out late entries). But, please note that I do drop one of almost everything! Don't panic if your clicker dies or you forget it one day - but deal with it quickly, that's how I know you're participating. (Please don't tell me you were there, there's no easy way for me to enter such info by hand.) That's one reason I'm automatically excusing three full classes worth of participation - more for forgetting your clicker (or dead batteries) than for skipping classes!

**Honor Code:** I'm a big fan of the CU honor code, and ask that everyone read and respect it! [http://www.colorado.edu/academics/honorcode/](http://www.colorado.edu/academics/honorcode/) Bringing someone else's clicker to class to give them credit is a direct and serious violation of the CU honor code - please don't do it, nor tolerate other people doing it. I know this is a big class, but I really want to establish an atmosphere of trust and respect. Please feel free to talk to me if anything is going on you're not comfortable with!

Summary of weekly deadlines:
- online participation due every Tuesday by noon (that's a half hour before class starts!)
- long answer and CAPA homework due Friday (generally midnight, but in-class Thursday if I give long answer questions that need to be hand-written that week, like homemabs)

**Help Room and Study Sessions:** We have a TA and an undergrad Learning Assistant (Jessica Bartley) who will be available to discuss course material and homework problems. We will set up fixed times for these and announce them on the web page, subject to interest we can add more or change the times - let us know! You can use the Physics Help Room (Basement of Duane Physics) M-F 9-5, look for a table with "Phys 1240" on it, and work with your fellow classmates.

There is lots more information on the online version of the syllabus - please check it out.

*Any information in this syllabus is as accurate as is possible at the time of writing. I reserve the right to make changes if it seems good to do so! Please see the web version for many more details. It is my goal to make this course responsive to your needs and interests. Talk to me if you're unhappy. (Talk to me if you're happy too, that's also helpful!) Announcements about changes of any kind will be made in class, and (hopefully) posted on the web, and will take precedence over this syllabus. You are of course responsible for what is said in class, whether or not you are in attendance.*
Some course goals: The topics of sound and music are part of our lives - not just for pleasure (though that's certainly a big part of it, and not to be neglected!) but also for communication, science, health and medicine, psychology, business... The "topics" we will cover (described below) are interesting and important learning goals, but there are much deeper course goals too: to help you learn to apply quantitative reasoning and problem solving skills to complex situations, to understand and appreciate the underlying physical principles involved, and to answer questions about and make sense of the phenomena of sound and music in your own life (e.g. wiring your speakers, setting them up properly in your room, preventing avoidable ear damage as you age, understanding noise and harmonics when playing, synthesizing, or just listening to music...) We will learn how to learn from a physics textbook (less obvious than it might appear, you can't just read it like a newspaper or novel!), and how to tackle both quantitative and qualitative problems. We'll develop some basic but essential math skills (esp. graphs and scientific notation). I want you to appreciate the nature of scientific argument (and the deep connections of scientific understanding to experiments), to increase your skills and confidence in physical "sense-making", and above all, to enjoy the course!

Tentative Syllabus: We will roughly be following the textbook throughout the semester, more closely after the first couple of weeks. In some cases, we will jump around a bit, the order of the chapters of the text is not especially "sequential", and there are cases where we can improve on the author's choices! Once we get going, it'll be a helpful resource. I anticipate roughly 1 chapter per week. You must keep up with the reading, it's very important!

The course starts with a brief survey covering the three basic and essential principles of the semester

#1 The production and "nature" of sound (in Chapters 1 and 3),
#2 The propagation of sound (in Chapters 2 and 4),
and #3 The detection and perception of sound (in Chapters 5 and 6).

The rest of the course will cycle back through these three big principles, filling in details and deepening the connections. We will talk more about the ingredients of music, and the oh-so-important idea of "harmonics". Then we'll visit instruments, figuring out how and why they work, what their character and nature is. We'll wrap up with issues of room acoustics and electronic synthesis, trying to pull together everything we've learned.

If you've never had any physics class before, some of the background ideas in the first couple of chapters will be a little tough going at first- but never fear, I won't assume you've had any formal training in physics or music) and we'll learn how to read this textbook and make sense of it! Your experiences in life have taught you all the physics you need - you just have to organize (and re-organize) how you think about it, add a few mental "models" with broad explanatory power, and sharpen up your understanding so that it consistently matches with physical reality!