“Measure what is measurable, and make measurable what is not so.”
  -- Galileo Galilei

STANFORD UNIVERSITY
PHYSICS 62 FALL QUARTER 2019

Course Staff
Julien Devin   jdevin@stanford.edu   60-203
TA Jannicke Pearkes jpearkes@stanford.edu
TA Xizhi Han   hanxzh@stanford.edu

Timely logistics for shopping: Stanford's shopping period is helpful but can lead to logistical difficulties, especially in labs. You can help your TAs and classmates by updating your enrollment as soon as you make a decision. If you are shopping this class, please either enroll (for now) or send a note to jdevin@stanford to be enrolled as a guest, so that you will not miss important on-line content and exercises.

Course Location: Bldg 60-207

Course Times
Section 01 – there is no separate lecture class time
Section 03 Tue 11:30-1:20
Section 04 Tue 1:30-3:20

Office Hours:
  Julien by appt
  TAs: Thursday during same lab times.

Course Objective
Your primary goal during this one-quarter class is to experience the process of experimental research in the context of classical mechanics. The key components of experimental research are beautifully outlined in Comparative Cognitive Task Analyses of Experimental Science and Instructional Laboratory Courses, by Carl Wieman (2013), which will be separately posted on our Canvas site under “Files”. A simplified version is below under “Key steps of experimental research”. This course is a step towards becoming a full-fledged expert. In consequence, this course may feel less guided than other lab courses. As one successful researcher wrote:

“An investigator starts research in a new field with faith, a foggy idea, and a few wild experiments. Eventually the interplay of negative and positive results guides the work. By the time the research is completed, he or she knows how it should have been started and conducted.”

-- Donald Cram
1987 Nobel Laureate in Chemistry

Our intent is to guide you in the process of planning, executing, and analyzing experiments as an expert. Experiencing creative uncertainty, and recognizing it, is a key part of learning to do research at the highest level.
The course is divided into 3 modules: We expect the first module to take 4 weeks, the second module is a one-week intermezzo, and the third module to take 5 weeks. In each case, you will go through an iterative process that will likely include the following key steps of experimental research:

**Key steps of experimental research**

1. Articulate the research question.
2. Design and construct the experiment.
3. Take data.
4. Analyze data.
5. Iterate as necessary at every step of the above process.
6. Present the work.

**Lab Notebooks:** We will ask every group to start a shared lab notebook using the collaboration link in Canvas. Here’s what to do:

- Create a Collaboration on Canvas for your lab group – these are not individual. One group member creates this, then invites the other group members; *please invite the Course Staff, too.*
- This takes you to a google doc which is inside the Stanford network. You will access it through Canvas, or from your Stanford google drive (which you login to using your SUNetID, not with your gmail address). If you wish to use a physical lab notebook you may do so and upload scans to your collaboration lab notebook.

The lab notebook is absolutely essential to the practicing experimentalist, both as a record and as a tool to aid communication and critical thinking. There will be periodic lab book checks. Please see the course document How to Keep a Lab Book in Canvas. (This document refers to hard-copy lab books, which P62 does not require, but follow these guidelines for your online lab book).

**Course format:** Sections meet for two hours of in-lab time with your teaching assistant. This class does not have a lecture hour. Instead, we will provide links to relevant information to which you can refer at your convenience.

There will be Prelab assignments (almost) every week which are due on Canvas at 11:59pm on Sunday nights. These are to be submitted individually. Your lab time will be much more productive and your learning experience will be much deeper if you some time before lab thinking about the tasks ahead, and some time after lab reflecting on your experiment and analyzing your data. We will post questions to encourage planning and reflection.

**Attendance:** Required. If you have to miss a class, email the course staff BEFOREHAND. A lot of the class is interactive, You will then make up the lab activities on Thursday of the same week during your normal section time, when TAs will have their office hours. If you are ill and can’t come on Thursday, let us know and we’ll determine an appropriate makeup.
**Grading**  Credit/No credit grading only. A 60% total score is required for credit.

The total score will be computed as follows:
30% for completion of assigned exercises (Pre-class, in-class, and post-class)
60% Final Reports for both modules (20% module 1, 40% module 2), to include lab results, analysis, and explanation.
10% course staff assessment of your contributions to your group