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

STANFORD UNIVERSITY
PHYSICS 62 FALL QUARTER 2014
QUESTIONS? KMOLER@STANFORD.EDU

Course Staff
Professor Kathryn A. Moler ("Kam"), kmoler@stanford.edu
TA John Bartel, jbartel@stanford.edu
TA Purnima Balakrishnan, purnimab@stanford.edu
Lab Manager Greg S. Romine, gsromine@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 kmoler@stanford to be enrolled as a guest, so that you will not miss important on-line content and exercises.

Course Location: Physics and Astrophysics Building (PAB), Sub-basement 12 (S12)

Course Times
Section 02 09/22/2014 - 12/05/2014 Tue 12:15 PM - 2:05 PM
Section 03 09/22/2014 - 12/05/2014 Tue 2:15 PM - 4:05 PM
Section 04 09/22/2014 - 12/05/2014 Wed 12:15 PM - 2:05 PM

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 coursework site under “materials”. 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

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.

Lab Notebooks: You must have at least one of the following two and may want both. (1) a lab notebook and a pen with indelible ink, and/or (2) you may use the online lab notebook, lab archives. I recommend lab archives and am arranging to cover its (modest) cost, but I can work with you if you have any concerns about using non-
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Stanford tools. If you choose to use a notebook should be bound, not spiral or looseleaf, and should have grid lines, not blank pages or only horizontal lines. The lab notebook is absolutely essential to the practicing experimentalist, both as a record and as a tool to aid communication and critical thinking. Please see the course document How to Keep a Lab Book. We will update it for the online lab archives pilot.

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. 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. Your timely answers to these questions will also help the course staff to help you and other students, so please stay alert for posts from the coursework website, which we will email to all enrolled students.

We expect the first module to take 3-4 weeks and the second module to take 6-5 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.

Teams: You will be randomly assigned to a group of three for the first module. The groups will be shuffled in week 4.

Grading
30% for completion of assigned exercises (Pre-class, in-class, and post-class)
60% lab results, analysis, and explanation (20% module 1, 40% module 2)
10% course staff assessment of your contributions to your group

Assigned exercises will be based on completion. Lab reports and assessed contributions will be shared with your group and based on a 10-point scale with 9-10 – excellent, 8-9 – very good, 7-8 – good, 5-6– fair, 1-4 – poor, 0 – missing. A grade of 10 should be reserved for exceptional work.

This course is credit/no credit grading only and 75% is required for credit.