

Syllabus for PHYS 77

S. Marzen

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Contact information:

- Instructor: Sarah Marzen
- Email: smarzen@natsci.claremont.edu,
- Office: E165
- If I'm sick or if there is a new horrible variant: Meeting ID: 511 196 0913, Password: Marzen
- Lectures are TR at 9:35-10:50 AM in CM Campus, The Kravis Center, 102
- Labs are R at 5:30-7:30 PM or 7:45-9:45 PM in NS E050, with which lab you're in TBD on the first day of class
- OH 11 AM-12 PM, 1 PM-2 PM, 4 PM- 5 PM W in my office

My aim is to foster a welcoming, inclusive environment where everyone feels emboldened to ask “stupid” questions, answer questions wrongly, and in general, just talk out of turn. My experience is that the “stupid” questions are usually the smartest, that wrong answers are more interesting than correct ones, and that random musings can lead to some really interesting ideas. The labs are designed to be difficult, but I promise, you can get them done with collaborative teamwork.

We will be musing over the progress of science. If you talk to someone outside of science, they may feel it is a dispassionate enterprise in which new ideas are proposed, evaluated coldly and without emotion, and taken to be correct if they pass muster. This is far from true. We will study exactly how. First, we will read a classic work describing a paradigm for paradigm shifts in science, *The Structure of Scientific Revolutions* by Kuhn. This is the only required text for the class. We will update Kuhn with the latest work on how, numerically, scientific revolutions happen. And then we will go into detail on several paradigm shifts to assess both the personalities and the science: first, going through the story of how the discovery happened and the context in which the discovery happened; and second, understanding the actual discovery itself, going as in-depth as, “What are F , m , and a in $F = ma$, and how do you even use this equation to do anything?” By the end of the course, you should have a global understanding of a large number of scientific fields and how they went from nothing to something.

The structure of the course is that past the first two weeks, every week starts with a discussion of the personalities and context in which a scientific discovery took place, and then moves to a discussion of the science itself. No more than algebra will be required for the latter. For the former, this course requires a significant amount of reading. I will scan pages from various autobiographies. Please, in order for this course to be successful, come to class with the excerpts having been read. This course relies on active participation from students. Without that, this course will be me talking and you listening for one hour and fifteen minutes twice a week, and I don't think either of us wants that!

Your grade in this class will be based on homeworks, labs, participation, and a final. I will give you free extensions on any homework. You just need to email me in advance. There is no extension allowed for the final.

Office hours: 11 AM-12 PM, 1 PM-2 PM, 4 PM- 5 PM Wednesdays in my office.

Homeworks: The homeworks will largely ask you to assess how a particular scientific discovery that we studied that week fits into Kuhn's paradigm. No more than a one-page response is required. Quality over quantity is appreciated!

Again, you can get free extensions anytime as long as you email me requesting, for any reason. Homeworks are due on select Fridays, to be determined based on the pacing of the class, as posted on Gradescope. You are absolutely encouraged to consult me and others in order to complete the problem set. There is no such thing as cheating, *unless* you use someone else's words without understanding their meaning. Only you will know if you understand what you are writing down, but be warned that failure to understand the homeworks can only hurt you on the other assessments.

ChatGPT or other LLMs are allowed for background research, but not as oracles that answer the question. If I catch you using an LLM as an oracle, I will first warn you that this is against policy, and then take off points at the next clear sign of use.

Labs: In labs, we will do the exciting task of recreating the scientific discoveries we study during lecture, using as much real data as I can get my hands on! Please bring your laptops to lab and make sure you have downloaded Excel and Mathematica! Let me know if you have any problems acquiring Excel or Mathematica. They should be available via your college. Numbers will also suffice for the days we work on Excel, but instructions will be written for Excel.

Final: The final exam will be done during the last class. You will be asked to recall the paradigm-shifting discoveries and also be asked to fit them into Kuhn's paradigm in free responses on blank paper. A notecard—8.5 × 11 inches—will be allowed, but nothing else. At the end of class, you will be asked to scan and upload to Gradescope.

Grades: The final grade is determined via

- Participation – 10%
- Homework – 20%
- Labs – 40%
- Final – 30%.

The grade cutoff is *no harsher than*

- A = 90%
- A- = 85%
- B+ = 80%
- B = 75%
- B- = 70%
- C+ = 65%
- C = 54%.

I may move cutoffs down (but not up) as I see fit at the end of the semester. Please do not trust Canvas' grade.

Accommodations: I have copied and pasted the following information from Deans about accommodations. If you have detailed questions about any of the following, please speak to the departments or coordinators listed.

Scripps students seeking to register for academic accommodations must contact the department of Academic Resources and Services (ARS) at ars@scrippscollege.edu or 909 – 621 – 8277 to formalize accommodation requests. Students will be required to schedule an intake with staff, complete the Disability Support Services Request form and submit documentation for approved academic accommodations. Once ARS has received documentation supporting the need for accommodations, ARS will work with faculty to ensure that faculty are in the loop regarding a student's request for accommodations and will consult where appropriate.

Pitzer students should contact Pitzer's Academic Support Services (PASS) in the Office of Student Affairs to inquire about accommodations and support services (<https://www.pitzer.edu/student-life/academic-support-services/>). It would be best for students to contact PASS early in the semester so that a collaborative plan can be developed for the academic year. PASS will work with students to identify reasonable and appropriate accommodations, and also follow up with a letter to relevant faculty members outlining specific accommodation options.

Generally, a student's home campus is responsible for establishing and providing accommodations. Below is a list of coordinators:

- Scripps: Academic Resources Services, ars@scrippscollege.edu or 909 – 621 – 8277
- CMC: Kari Rood, kari.rood@claremontmckenna.edu
- HMC: Brandon Ice, bice@g.hmc.edu
- Pitzer: Gabriella Tempestoso, gabriella.tempestoso@pitzer.edu
- Pomona: Jan Collins-Eaglin, jan.collins-eaglin@pomona.edu
- Claremont Graduate Institute: Quamina Carter, quamina.carter@cgu.edu

Students who have conflicts with labs or exams due to religious holidays should see me in advance of the exam.

My Accommodations: I also have accommodations, and there may be a situation in which I need to reschedule class. This will happen no more than once per semester. If I reschedule class, there will be a “choose your own adventure” – you can either watch a recording in Box, or you can come to a rescheduled night class at a time TBD.

Schedule: We will go over the following topics in the following order at whatever pace makes sense.

- Kuhn's paradigm (1 week)
- Science of Science, or Kuhn's paradigm revisited (1 week)
- Isaac Newton, 1687 (2 weeks)
- Charles Darwin, 1838 (2 weeks)
- Development of the computer, 1842 onwards (2 weeks)
- Ludwig Boltzmann, 1877 (2 weeks)
- Albert Einstein, 1921 (2 weeks)
- John Nash, 1950 (2 weeks)
- Discovery of DNA's structure, 1953 (2 weeks)