Interdisciplinary Courses in an Old Discipline

- Some background about our department
- What has been successful
- What has not
- The Future of our Field
The Department of Physics and Astronomy

- Incoming Class of 20 - roughly 100 students
- 37 faculty with widely varied research programs: Astrophysics, Biological Physics, Biomedical Optics, Hard and Soft Condensed Matter, Cosmology, High Energy Theory and Experiment
- We aim to recruit students with Astronomy, Applied Math, Biology, and Physics backgrounds
What we required before* the war

*no astronomy, astrophysics, or biological physics but we did have an active nuclear physics program

- Electricity + Magnetism (two semesters)
- Quantum Mechanics (two semesters)
- Field Theory (one semester)
- Nuclear Physics (one semester)
- Statistical Mechanics (one semester)
- Classical Mechanics (one semester)
- Graduate Laboratory (one semester)

+ Comprehensive Exams in Quantum Mechanics and Electricity and Magnetism

But, in 1994 we ramped down nuclear physics and added astrophysics
What we require now

- Electricity + Magnetism (one semester)
- Quantum Mechanics (two semesters)
- Mathematical Methods of Physics (one semester)
- Statistical Mechanics (one semester)
- One course outside the student’s field of study

**Rationale**

- Students come to do research
- Faculty don’t want to pay for students to take classes (especially hard classes)
- We are educating a much wider range of students – from wet biologists to astronomers
- In principle, there is more room for electives (see the second point, however)
Results Consequences
Successes

Soft Matter

Biological Physics

+ Significant External Supervision of Theses: Biophysics and biochemistry (Medical School), Chemical Engineering, Chemistry, Materials Science, Biology
Failures

- Students take ever fewer courses
- Fewer courses means we can offer fewer electives
- Breadth requirement is *ad hoc* and typically does not serve the students in the long term
- One semester of Electricity and Magnetism has not been easy to navigate. Tradeoff between new topics (radiative transfer, biophysics) with older topics. Both students and faculty are of mixed minds about this.
Electricity and Magnetism

☐ How do we make a course that serves interdisciplinary research?

☐ We are committed to teaching graduate courses by active researchers in that subject -- this is easy to do in quantum mechanics, mathematical methods, statistical mechanics, and so on. It is very difficult to achieve this in Electricity and Magnetism.

☐ How do we update a 100 year old+ topic?

☐ Our thought: math methods instead of electrostatics + modern topics in radiation and transport
The Future

☐ As our field moves forward our curriculum must as well -- we currently require a 50-100 year old set of subjects.

☐ When do we move forward? If not now, when?

☐ Desires of the students versus needs of the faculty

☐ Time for discussion